

ALBERT R. MANN
LIBRARY
AT
CORNELL UNIVERSITY





DATE DUE

GAYLORD			PRINTED IN U.S.A.



Digitized by the Internet Archive
in 2025 with funding from
Cornell University Library

<https://archive.org/details/mycotaxon58unse>

MYCOTAXON

AN INTERNATIONAL JOURNAL FOR RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

Volume LVIII

April-June 1996

CONTENTS

Studies on <i>Gloeocystidiellum</i> sensu lato (Basidiomycotina) in Taiwan.	Sheng-Hua Wu	1
<i>Albugo</i> spp. on the Gentianaceae	Michael J. Priest	69
A Comparative Study on <i>Punctelia colombiana</i> and <i>Punctelia sticta</i> (Parmeliaceae, Lichenized Ascomycotina).	Mónica T. Adler	77
The Genus <i>Phytophthora</i> in Mainland China	H. H. Ho	93
<i>Gliocladiopsis irregularis</i> sp. nov. and Notes on <i>Cylindrocladium spathiphylli</i> . P. W. Crous and A. Peeraly		119
Polypores from Bonin Is. (Japan) II. Two New Species of <i>Phellinus</i> (Hymenochaetaceae, Basidiomycotina).	Tsutomu Hattori and Leif Ryvarden	129
Notes on Hyphomycetes. LXXI. Further Novel Leaf Spot-Inducing Species of <i>Phaeoramularia</i> from the Indian Subcontinent. Sanjay K. Singh, Ritesh K. Chaudhary and Gareth Morgan-Jones		137
Noteworthy Reports on <i>Anzia</i> (Lichenized Ascomycotina) from Southern South-America. Susana Calvelo		147
Notes on Korean Cercosporae and Allied Genera. Hyeon-dong Shin and Uwe Braun		157
New Ustilaginales on Cyperaceae from Australia. Kálmán Vánky and Kirsten A. Websdane		167
Lichens and Lichenicolous Fungi of the Northern Krasnoyarsk Territory, Central Siberia. Mikhail Zhurbenko		185
<i>Scutellinia totaranuiensis</i> spec. nov., a New Species from New Zealand (Discomycetes, Pezizales).	Jiří Moravec	233
Notes on Conidial Fungi. VII. Two New Species of <i>Beltraniella</i> from Cuba. R. F. Castañeda Ruiz, J. Cano and J. Guarro		243
Notes on Conidial Fungi. VIII. Two New Species of <i>Dactylaria</i> from Cuba. R. F. Castañeda Ruiz, J. Guarro and J. Cano		253
Comments on the Exsiccat "Lecanoroid Lichens" III. H. T. Lumbsch and G. B. Feige		259
The Lichen Genus <i>Diploschistes</i> in South Africa (Thelotremaaceae). Roland Guderley and H. Thorsten Lumbsch		269
The Genus <i>Dimelaena</i> (Lichenized Ascomycetes, Physciaceae) in the Southern Hemisphere. Helmut Mayrhofer, Mario Matzer, Anita Wippel and John A. Elix		293
<i>Peronospora</i> on <i>Acaena</i> (Rosaceae).	O. Constantinescu	313
A New Species of <i>Miriquidica</i> from the Coastal Desert in Baja California. G. Rambold, H. Sipman and H. Hertel		319
<i>Sphaerophragmium quadricellulare</i> sp. nov. (Mycota, Uredinales) on <i>Acacia</i> in Australia, with Brief Notes on Some Related Rust Genera.	J. L. Alcorn and J. Walker	325
Studies on Italian Gasteromycetes. I. Two New Species of <i>Arachnion</i> and <i>Radiigera</i> (Basidiomycotina, Lycoperdales) from Rome and its Environs	Livio Quadraccia	331
Studies on Mediterranean Hyphomycetes. I. <i>Pseudospiropes dumeti</i> sp. nov. Dario Lunghini and Flavia Pinzari		343

[Contents continued inside front cover]

ISSN 0093-4666

MYXNAE 58: 1-532 (1996)

For subscription details, availability in microfilm and microfiche,
and availability of articles as tear sheets, see back cover.

QK
600
M992
V. 5-8

[Contents continued from front cover]

1996	Two More Species of <i>Amphisphaeria</i> (Xylariales).	
	Margaret E. Barr and Annette W. Ramaley	349
	An Analysis of Works Of and Upon, Curtis Gates Lloyd.	
	Will H. Blackwell and Martha J. Powell	353
	New Report of Lichens from Southern Africa C. M. Thomas and R. B. Bhat	375
	Studies on North American Cortinarii II. Interesting and New Species Collected in the North Cascade Mountains, Washington. M. M. Moser and J. F. Ammirati	387
	Taxonomy of <i>Daedalea roseola</i> comb. nov. Anjali Roy and A. B. De	413
	<i>Valsaria</i> and Notes on <i>Endoxylina</i> , <i>Pseudothyridaria</i> , <i>Pseudovalsaria</i> and <i>Roussoella</i> .	
	Yu-Ming Ju, Jack D. Rogers and Sabine M. Huhndorf	419
	Mexican Fungi: <i>Xylaria entosulphurea</i> sp. nov. and Neotypification of <i>Entonaema</i> <i>globosum</i> Jack D. Rogers, Felipe San Martin and Yu-Ming Ju	483
	Some <i>Asterinella</i> , <i>Asterostomella</i> and <i>Echidnodella</i> Species from Southern India.	
	V. B. Hosagoudar, M. P. Balakrishnan and R. D. Goos	489
	Book Reviews D. S. Hibbett	499
	NOTICE: Publication of S. C. Teng's Fungi of China.	507
	NOTICE: Repurchase of Back Volumes of MYCOTAXON.	508
	Errata.	509
	Author Index	510
	Index to Fungous and Lichen Taxa.	512
	Reviewers.	532
	Publications Date, Volume 57.	532

MYCOTAXON

AN INTERNATIONAL JOURNAL OF RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

VOLUME LVIII, 1996

COMPLETE IN ONE VOLUME
CONSISTING OF iv + 532 PAGES INCLUDING FIGURES

EDITOR-IN-CHIEF

Jean Boise Cargill

Harvard University Herbaria, 22 Divinity Ave.
Cambridge, MA 02138-2094, USA

Pavel Lizon

Assistant to the Editor-in-Chief
Plant Pathology Herbarium
Cornell University, Ithaca, NY 14853

ASSOCIATE EDITORS

David S. Hibbett

Book Review Editor
Harvard University Herbaria, 22 Divinity Ave.
Cambridge, MA 02138-2094, USA

Grégoire L. Hennebert

French Language Editor
32 Rue de l'Élevage
B-1340 Ottignies -LLN, Belgium

Karen Gettleman

Index Editor
Indiana University
Bloomington, IN, USA

EDITORIAL ADVISORY BOARD

JAMES W. KIMBROUGH, Gainesville, Florida (1992-97, *Chm.*)

AMY Y. ROSSMAN, Beltsville, Maryland (1990-95)

GREGOIRE L. HENNEBERT, Louvain-la-Neuve, Belgium (1990-96)

JACK D. ROGERS, Pullman, Washington (1993-98)

OVE ERIKSSON, Umeå, Sweden (1994-99)

RONALD H. PETERSEN, Knoxville, Tennessee (1995-2000)

Published by

MYCOTAXON, LTD.P.O.BOX 264
ITHACA, NY 14851-0264, USA

Printed in the United States of America

© Mycotaxon, Ltd., 1996

Table of Contents, Volume Fifty-Eight **April-June 1996**

Studies on <i>Gloeocystidiellum</i> sensu lato (Basidiomycotina) in Taiwan.	Sheng-Hua Wu	1
<i>Albugo</i> spp. on the Gentianaceae.	Michael J. Priest	69
A Comparative Study on <i>Punctelia colombiana</i> and <i>Punctelia sticta</i> (Parmeliaceae, Lichenized Ascomycotina)	Mónica T. Adler	77
The Genus <i>Phytophthora</i> in Mainland China	H. H. Ho	93
<i>Gliocladiopsis irregularis</i> sp. nov. and Notes on <i>Cylindrocladium spathiphylli</i> . P. W. Crous and A. Peeraly		119
Polypores from Bonin Is. (Japan) II. Two New Species of <i>Phellinus</i> (Hymenochaetaceae, Basidiomycotina). Tsutomu Hattori and Leif Ryvarden		129
Notes on Hyphomycetes. LXXI. Further Novel Leaf Spot-Inducing Species of <i>Phaeoramularia</i> from the Indian Subcontinent. Sanjay K. Singh, Ritesh K. Chaudhary and Gareth Morgan-Jones		137
Noteworthy Reports on <i>Anzia</i> (Lichenized Ascomycotina) from Southern South-America. Susana Calvelo		147
Notes on Korean Cercosporae and Allied Genera. Hyeon-dong Shin and Uwe Braun		157
New Ustilaginales on Cyperaceae from Australia. Kálman Vánky and Kirsten A. Websdane		167
Lichens and Lichenicolous Fungi of the Northern Krasnoyarsk Territory, Central Siberia. Mikhail Zhurbenko		185
<i>Scutellinia totaranuiensis</i> spec. nov., a New Species from New Zealand (Discomycetes, Pezizales)	Jiří Moravec	233
Notes on Conidial Fungi. VII. Two New Species of <i>Beltraniella</i> from Cuba. R. F. Castañeda Ruiz, J. Cano and J. Guarro		243
Notes on Conidial Fungi. VIII. Two New Species of <i>Dactylaria</i> from Cuba. R. F. Castañeda Ruiz, J. Guarro and J. Cano		253
Comments on the Exsiccat "Lecanoroid Lichens" III. H. T. Lumbsch and G. B. Feige		259
The Lichen Genus <i>Diploschistes</i> in South Africa (Thelotremataceae). Roland Guderley and H. Thorsten Lumbsch		269
The Genus <i>Dimelaena</i> (Lichenized Ascomycetes, Physciaceae) in the Southern Hemisphere. Helmut Mayrhofer, Mario Matzer, Anita Wippel and John A. Elix		293
<i>Peronospora</i> on <i>Acaena</i> (Rosaceae)	O. Constantinescu	313
A New Species of <i>Miriquidica</i> from the Coastal Desert in Baja California. G. Rambold, H. Sipman and H. Hertel		319
<i>Sphaerophragmium quadricellulare</i> sp. nov. (Mycota, Uredinales) on <i>Acacia</i> in Australia, with Brief Notes on Some Related Rust Genera. J. L. Alcorn and J. Walker		325
Studies on Italian Gasteromycetes. I. Two New Species of <i>Arachnion</i> and <i>Radiigera</i> (Basidiomycotina, Lycoperdales) from Rome and its Environs. Livio Quadraccia		331
Studies on Mediterranean Hyphomycetes. I. <i>Pseudospiropes dumeti</i> sp. nov. Dario Lunghini and Flavia Pinzari		343
Two More Species of <i>Amphisphaeria</i> (Xylariales). Margaret E. Barr and Annette W. Ramaley		349
An Analysis of Works Of and Upon, Curtis Gates Lloyd. Will H. Blackwell and Martha J. Powell		353

New Report of Lichens from Southern Africa . . .	C. M. Thomas and R. B. Bhat	375
Studies on North American Cortinariid II. Interesting and New Species Collected in the North Cascade Mountains, Washington.	M. M. Moser and J. F. Ammirati	387
Taxonomy of <i>Daedalea roseola</i> comb. nov.	Anjali Roy and A. B. De	413
<i>Valsaria</i> and Notes on <i>Endoxylina</i> , <i>Pseudothyridaria</i> , <i>Pseudovalsaria</i> and <i>Roussoella</i> .	Yu-Ming Ju, Jack D. Rogers and Sabine M. Huhndorf	419
Mexican Fungi: <i>Xylaria entosulphurea</i> sp. nov. and Neotypification of <i>Entonaema globosum</i>	Jack D. Rogers, Felipe San Martin and Yu-Ming Ju	483
Some <i>Asterinella</i> , <i>Asterostomella</i> and <i>Echidnodella</i> Species from Southern India.	V. B. Hosagoudar, M. P. Balakrishnan and R. D. Goos	489
Book Reviews	D. S. Hibbett	499
NOTICE: Publication of S. C. Teng's Fungi of China		507
NOTICE: Repurchase of Back Volumes of MYCOTAXON		508
Errata		509
Author Index		510
Index to Fungous and Lichen Taxa		512
Reviewers		532
Publications Date, Volume 57.		532

STUDIES ON *GLOEOCYSTIDIELLUM* SENSU LATO (BASIDIOMYCOTINA) IN TAIWAN

Sheng-Hua Wu

National Museum of Natural Science, Taichung, Taiwan, 40419
Republic of China

ABSTRACT

Material of *Gloeocystidiellum* Donk sensu lato for this study was collected in Taiwan during 1988-1994. Apart from the main purpose of surveying components of this group in Taiwan, efforts were also made to delimit several genera which have been segregated from *Gloeocystidiellum* s.l. The main features used to separate these genera include nuclear behavior, basidial shape, hyphal septation, hyphal system and spore ornamentation. Special emphasis is also given to discussion of the taxonomic placement of *Gloeocystidiellum* s.l. Auriscalpioideae, Hericioideae and Wrightoporiodeae are proposed as new subfamilies in the Auriscalpiaceae. Six genera are recognized in this study including a proposed new genus, *Gloeomyces*. Based on the Taiwanese collections, twenty-two species are described. Six species are newly recorded from Taiwan, viz. *Conferticium heimii*, *C. ochraceum*, *C. ravum*, *Gloeocystidiellum aspellum*, *G. porosum* and *Megalocystidium luridum*. Fifteen new species are described, viz. *Boidinia cana*, *B. granulata*, *B. luteola*, *B. macrospora*, *Gloeocystidiellum aculeatum*, *G. compactum*, *G. formosanum*, *G. laxum*, *G. moniliforme*, *G. purpureum*, *G. tabacinum*, *Gloeomyces ginnsii*, *G. graminicola*, *Gloiothele citrinoidea* and *G. globosa*. Collections of most new species, were made from subtropical or tropical belts of Taiwan. New combinations are proposed for: *Boidinia inconstans*, *C. heimii*, *Gloiothele zawitense*, *Megalocystidium luteocystidiatum* and *Stereum wakullum*. Descriptions and line drawings are given for each species. Basidiospore SEM photographs are provided for those with ornamented surfaces. Results of cultural and cytological studies are provided for many species.

Key words: Auriscalpioideae, Basidiomycotina, *Boidinia*, *Conferticium*, cultural studies, *Gloeocystidiellum*, *Gloeomyces*, *Gloiothele*, Hericioideae, *Megalocystidium*, Taiwan, Wrightoporiodeae.

INTRODUCTION

Gloeocystidiellum sensu lato

Gloeocystidiellum s.l. is interpreted in the sense of the emended genus *Gloeocystidiellum* Donk em. Donk proposed by Donk (1956). The genus *Gloeocystidiellum* Donk was originally erected by Donk (1931) for nomenclatural reasons as a substitute for *Gloeocystidium* Karst. Höhnelt & Litschauer (1908) and Bourdot & Galzin (1913, 1928) misapplied the *Gloeocystidium* concept of Karsten (1889). *Gloeocystidium* was conceived by them as different from *Corticium* Fr. by the presence of gloeocystidia, and from *Peniophora* by the lack of "cystidia" (encrusted cystidia). However, two of Karsten's species of *Gloeocystidium*, *G. guttuliferum* and *G. exsudans*, lack gloeocystidia. Thus, the species treated by Karsten in *Gloeocystidium* were transferred by these mycologists to other genera, but the name *Gloeocystidium* was retained in a different sense. Burt (1926) thus rejected *Gloeocystidium* and transferred the apparently misapplied members to *Corticium*, because he did not regard the presence of gloeocystidia as important for recognizing a separate genus. Donk (1931) proposed a new genus *Gloeocystidiellum* for the misapplied *Gloeocystidium*, but meanwhile stated that it was an artificial genus. Later, Donk (1956) emended and restricted *Gloeocystidiellum* to certain species of Bourdot & Galzin's sections *Amyloidea* Bourd. & Galz., *Ceracea* Bourd. & Galz. and *Insidiosa* Bourd. & Galz., which are characterized by gloeocystidia and amyloid basidiospores.

The emended *Gloeocystidiellum* was widely accepted for corticioid basidiomycetes with monomitic hyphal system, euhymenium, gloeocystidia and amyloid basidiospores (e.g., Eriksson 1958, Donk 1964, Parmasto 1968, Eriksson & Ryvarden 1975 and Freeman 1978). Before this study, *Gloeocystidiellum* s.l. contained about forty species, mainly from temperate zones. However, even in its more restricted sense the emended *Gloeocystidiellum* was (e.g., Donk 1964:271) regarded as rather heterogeneous. Eriksson & Ryvarden (1975:404) also remarked that the presence of gloeocystidia and amyloid spores alone does not form a sufficient base for a natural genus. Therefore Eriksson & Ryvarden (1975) subdivided *Gloeocystidiellum* s.l. into seven groups, based on features such as hyphal septation, cyanophily of hyphae, texture of fruit body, nature of spore wall, shape of spore and sulfoaldehyde reaction of gloeocystidia. The seven groups are: *G. porosum* group, *G. convolvens* group, *G. ochraceum* group, *G. furfuraceum* group, *G. luridum* group, *G. lactescens* group and *G. citrinum* group. This subdivision was subsequently accepted by some other mycologists as a basis for new genera segregated from *Gloeocystidiellum* s.l.

Genera segregated from *Gloeocystidiellum* s.l.

The first genus to be segregated from *Gloeocystidiellum* s.l. was *Vesiculomyces* Hagström (Hagström 1977), accommodating *Thelephora citrina*

Pers. *Vesiculomyces* was proposed to represent the *G. citrinum* group, which is characterized by SA- gloecystidia, simple-septate hyphae, almost spherical basidiospores and long and narrow basidia (according to Hagström 1977).

Megalocystidium Jül., based on members of the *G. luridum* and *G. lactescens* groups, was erected by Jülich (1978). But in the protologue, no explanation was given for the concept of this genus. Etymologically, it seems that the main diagnostic feature of *Megalocystidium* lies in the big cystidia (gloeocystidia). Nevertheless, gloecystidia of the species included by Jülich are not distinctly bigger than those of others among *Gloeocystidiellum* s.l. Species of the *G. luridum* and *G. lactescens* groups have SA+ gloecystidia and smooth basidiospores, but the *G. luridum* group consists of clamped species and *G. lactescens* species lack clamps. Boidin & Lanquetin (1983) broadened the concept of *Vesiculomyces* to accommodate species with SA+ gloecystidia and clamped hyphae because they did not consider hyphal septation to be a consistent feature for delimiting a genus, and also because the gloecystidia of *G. citrinum* are SA+ in culture (Boidin 1958). Consequently, they regarded *Megalocystidium* as a synonym of *Vesiculomyces*.

Hjortstam (1987a:69) found features of the type species of *Gloiothele* Bres., *G. lamellosa* (P. Henn.) Bres., agree perfectly with those of *Thelephora lactescens* Berk. (*Gloeocystidiellum lactescens* group), except that the former has hyphal pegs. He thus treated some species characterized by features of the *G. lactescens* group in the genus *Gloiothele*. *Vesiculomyces epitheloides* Boid. & Lanquetin (Boidin & Lanquetin 1983), was regarded by Hjortstam (1987a) the same as the type species of *Gloiothele*. Ginns & Freeman (1994) transferred the type species of *Vesiculomyces*, *T. citrina* to *Gloiothele*. The combination of the *Gloeocystidiellum citrinum* group and the *G. lactescens* group together in the genus *Gloiothele* is accepted in this study. The only main difference between the two groups is the SA reaction of the gloecystidia, which is SA+ in *Gloeocystidiellum lactescens* group, and SA- in other one. But as mentioned above, this reaction of the *G. citrinum* group is positive in cultures. Moreover, the known nuclear behaviors of members of these two groups, viz. *Gloiothele citrina* (Pers.) Ginns & Freeman (Boidin 1958), *G. lactescens* (Boidin 1958) and *G. lamellosa* (as *V. epitheloides*, Boidin & Lanquetin 1983) are all subnormal, strongly supporting the close affinity between the two groups.

In this study, *Megalocystidium* is restricted only to the *Gloeocystidiellum luridum* group, characterized by clamped hyphae, clavate basidia, as well as smooth or minutely verrucose basidiospores. Known species of this genus also have longer basidia and bigger basidiospores, compared with other genera of *Gloeocystidiellum* s.l. From cytological studies, *M. leucoxanthum* was reported (Boidin 1958) as having heterocytic nuclear behavior. The plurinucleate state of monosporous mycelium in *M. luridum* (Boidin 1958) suggests the same nuclear behavior.

The genus *Conferticium* Hallenb. was segregated from *Gloeocystidiellum* s.l. by Hallenberg (1980). This genus is representative of the *G. ochraceum* group.

Conferticium is distinguished from other genera of *Gloeocystidiellum* s.l. by combined characteristics such as simple-septate hyphae, very dense pseudoparenchymatic context consisting of vertical and cyanophilous hyphae, and the internal basidial repetition. The holocoenocytic nuclear behavior of this genus (*C. ochraceum*, reported by Boidin 1966b) further distinguishes this genus. In this study, the finding of holocoenocytic nuclear behavior of *C. heimii* and *C. ravum*, confirms that these three species belong into the same genus. All studies based on fruit bodies revealed that *Conferticium* is a clampless genus. However, the presence of single, double and multiple clamped hyphae in cultures (e.g., Nakasone 1990) of this genus may reflect the phenomenon of holocoenocytic nuclear behavior.

Boidinia Stalpers & Hjortst. was segregated by Hjortstam & Stalpers (1982) from *Gloeocystidiellum* s.l., and the type species, *B. furfuracea* (Bres.) Stalpers & Hjortst. represents the *G. furfuraceum* group. This genus is diagnostically characterized by the presence of suburniform basidia and ornamented basidiospores. At first, only a clamped species was treated in *Boidinia* (Hjortstam & Stalpers 1982). Hjortstam & Ryvarden (1988) broadened the generic concept and included in *Boidinia* some clampless species. The emended *Boidinia* is temporarily accepted in this study. Owing to the addition of more species in this genus, the original sense of the *G. furfuraceum* group based on only one species (Eriksson & Ryvarden 1975:404), such as loose texture, clamped hyphae and globose spores, somewhat deviates from the concept of *Boidinia* we know now. Cytologically, *B. furfuracea* seems to have normal nuclear behavior (Boidin & Lanquetin 1984). In this study, *B. granulata* is found to have bipolar sexuality with normal nuclear behavior, while *B. macrospora* is homothallic with holodikaryotic nuclear behavior. In corticioid basidiomycetes, homothallic species and heterothallic species can be accommodated in the same genus (cf. Boidin 1990).

The genus *Amylosporomyces* Rattan was erected based on a cystidium-lacking species (Rattan 1977). Hjortstam & Ryvarden (1988) added *Corticium subasperisporum* Litsch. as second species of *Amylosporomyces* and remarked that two species share dense tissue of basidiome and similar shape of basidia and basidiospores, although *C. subasperisporum* have gloecystidia. Ginns & Freeman (1994) accepted the treatment of Hjortstam & Ryvarden. *Corticium subasperisporum* was placed by Jülich (1982) in *Boidinia*, viz. *B. subasperispora* (Litsch.) Jül., because having main features of this genus. Further evidence is needed to group species with "reniform" basidiospores together in *Amylosporomyces*, as taxonomically distinguished from those of *Boidinia*. Presently I still regard *Amylosporomyces* as a cystidium-lacking *Boidinia*-like genus.

Jülich (1982) established *Gloeocystidiopsis* Jül. based on *Gloeocystidiellum flammeum* Boid. and *G. heimii*, and designated the former as type species. In the protologue, the only feature mentioned for this genus was the coenocytic hyphae, which lack clamps or only sometimes have a few verticillate clamps. However,

this characteristic is found in the genus *Conferticium*. Holocoenocytic nuclear behavior of these two species have been reported by Boidin (1966b). After studying specimens of *G. flammeum* (holotype, LY 5284) and *G. heimii* (LY 6116), features of the latter fit well the concept of *Conferticium* described above. The holotype of *G. flammeum* studied by me, hyphae are acyanophilous, further basidia are fairly uniformly thin-walled and without indication of basidial repetition. The cyanophilic hyphae may not always be a consistent feature in a genus. For instance, the basidiome hyphae of *Hyphodontia* John Erikss. and *Peniophora* Cooke are cyanophilous in some species, acyanophilous in others. However, whether presence of repetitive basidia in *G. flammeum* can be understood by ultrastructural studies as have been undertaken by Hallenberg (1981) for *Conferticium* species, to prove should *Gloeocystidiopsis* be a synonym of *Conferticium*, or an independent genus.

The segregation of several genera from *Gloeocystidiellum* s.l. by the above-mentioned authors, chiefly according to the several groups proposed by Eriksson & Ryvarden (1975), is basically accepted with some amendments in this study. *Gloeocystidiellum* s.s. presently consists of the *G. porosum* and *G. convolvens* groups, i.e. also accommodating clampless members. Further study is needed to determine whether they should be kept together. Homogeneous genera composed of clamped and clampless members, are not uncommon in corticioid basidiomycetes. With caution, separation of these genera can be achieved based on fruit body studies alone. However, cultural and cytological studies may aid for their separation. Both the broad and narrow concepts of *Gloeocystidiellum*, are currently being used for describing species. Clear delimitations of these genera, have not been examined or accepted by many mycologists. Diagnostic features of the six genera of *Gloeocystidiellum* s.l., employed in this study, are given below.

1. ***Boidinia* (*G. furfuraceum* group):** Monomitic. Hyphae clamped or clampless. Basidia suburniform. Basidiospores aculeate or verrucose, amyloid. Nuclear behavior normal.
2. ***Conferticium* (*G. ochraceum* group):** Monomitic. Fruit body compact, pseudoparenchymatic context with cyanophilous and clampless hyphae. Basidia clavate, with internal repetition. Basidiospores verrucose or smooth, amyloid. Nuclear behavior holocoenocytic.
3. ***Gloeocystidiellum* (*G. porosum* & *G. convolvens* groups):** Monomitic. Hyphae acyanophilous, clamped or clampless. Basidia clavate. Basidiospores verrucose or aculeate, amyloid. Nuclear behavior normal or subnormal.
4. ***Gloeomyces* (new genus):** Dimitic. Generative hyphae clampless. Binding hyphae scattered in deep subiculum, IKI-. Basidia utriform. Basidiospores smooth, weakly amyloid. Nuclear behavior indicated to be holocoenocytic.
5. ***Gloiothele* (*Gloeocystidiellum citrinum* & *G. lactescens* groups):** Monomitic. Hyphae simple-septate. Basidia irregularly clavate, occasionally somewhat utriform. Basidiospores smooth, weakly amyloid. Nuclear behavior subnormal.
6. ***Megalocystidium* (*G. luridum* group):** Monomitic. Hyphae clamped. Basidia clavate,

usually longer than 40 μm . Basidiospores smooth or almost so, thin-walled, amyloid. Nuclear behavior heterocytic.

Earlier studies of *Gloeocystidiellum* s.l. in Taiwan

Only three published articles have treated *Gloeocystidiellum* s.l. in Taiwan. Wu & Chen (1990) reported *Vesiculomyces citrinus* ($\equiv$ *Gloiothele citrina*) as a new record, but they reported that the Taiwanese collection had distinctly larger basidiospores than those in collections from temperate zones of other countries. The specimen Wu & Chen studied is treated in this paper as a new species: *G. citrinoidea*.

Lin & Chen (1990) reported *Gloeocystidiellum lactescens* ($\equiv$ *Gloiothele lactescens*) as a new record, and *Gloeocystidiellum luridum* ($\equiv$ *Megalocystidium luridum*) var. *microsporum* Z.C. Chen & S.H. Lin as a new variety in their studies of corticioid basidiomycetes of Taiwan. I have studied specimen no. NTU-2567 which they identified as "*G. lactescens*". The basidiospore dimensions, accurately measured by them as $6.2\text{--}7 \times 5\text{--}6 \mu\text{m}$, are broader than those of *G. lactescens*. In this and other features NTU-2567 conforms to *Gloeocystidiellum orientale* Parm. The Taiwanese collection was collected at 2600 m altitude, sharing a temperate habitat similar to that of the type specimen from Europe. Features such as simple-septate hyphae, smooth-walled and globose-subglobose basidiospores correspond with the concept of *Gloiothele*. Nevertheless, *Gloeocystidiellum orientale* was questioned to be a young form of *G. lactescens* by Eriksson & Ryvarden (1975: 424).

Unfortunately I could not find from TAI type material of *G. luridum* var. *microsporum*. According to the protologue, *G. luridum* var. *microsporum* may be a synonym of *G. luteocystidium* (Talbot) Boid. var. *brevisporum* Rattan. Basidiospores of the latter were reported to be $4.5\text{--}6.5$ (-8.5) $\times$ $4\text{--}4.5 \mu\text{m}$ (Rattan 1977), but those of the same specimen were measured by Freeman (1978) as $5.5\text{--}6 \times 3\text{--}3.5 \mu\text{m}$, similar to those described for *G. luridum* var. *microsporum* ($5\text{--}6 \times 3\text{--}3.5 \mu\text{m}$, from the protologue). The thin fruit body and thin hymenial layer, described for *G. luridum* var. *microsporum*, may reflect the young growth stage of the type collection. Basidiospores of *G. luteocystidium* var. *brevisporum* are much smaller than those of the type variety, and with no overlap between them (measurements from type specimens of two varieties by Freeman 1978). Therefore var. *brevisporum* should be promoted to species level, but then its generic placement would become a problem. It could be regarded as a member of *Megalocystidium*, on account of its clamped hyphae and smooth-walled basidiospores, but known species of this genus have fairly long basidia and larger basidiospores. Judging from the length of basidia and size of basidiospores, another possibility is the genus *Gloeocystidiellum* s.s., if smooth-spored species can be accommodated. Cytological studies should be undertaken before the decision of its generic placement is made.

Two *Gloeocystidiellum* s.l. species, *G. convolvens* (Karst.) Donk and

Gloiothele lactescens (as *Gloeocystidiellum lactescens*), have been reported by Maekawa (1992) as collected from Lan-Yu Island (South Eastern Taiwan). The material of Maekawa's *G. lactescens* is from a subtropical location, as are my collections of this species in Taiwan.

Taxonomic placement of *Gloeocystidiellum* s.l.

The problem of taxonomic placement of *Gloeocystidiellum* s.l. is far from settled, like many other members of the corticioid basidiomycetes. In Donk's (1964) treatment of the families of the Aphyllophorales, he regarded *Gloeocystidiellum* as partly in the Corticiaceae (the family also regarded by him as a highly artificial assemblage), but he also mentioned the connection (as a resupinate form) with the Hericiaceae. Parmasto (1968) established the subfamily *Gloeocystidielloideae* in the Corticiaceae to accommodate *Gloeocystidiellum* and *Laxitextum*. *Gloeocystidiellum* s.l. has long been treated by most mycologists as a member of the Corticiaceae s.l. (e.g., Eriksson 1958, Donk 1964, Gilbertson 1974, Eriksson & Ryvarden 1975, Parmasto 1986, Tellería 1990). A few mycologists regard this group as a member of the *Hericiaceae* (e.g., Rattan 1977). Jülich (1981) erected the new family *Gloeocystidiellaceae* Jül., and placed this family and some others characterized by gloeocystidia (or gloeoplerous hyphae) and amyloid basidiospores under his new order *Hericiales* Jül. Ginns & Freeman (1994) adopted the *Gloeocystidiellaceae* for their studies of the eight genera of North America, but they remarked that the family is heterogeneous and apparently polyphyletic.

There are several groups of lignicolous basidiomycetes with gloeocystidia (or gloeoplerous hyphae) and amyloid basidiospores. They are: *Aleurodiscus* s.l. (*Aleurodiscoideae* (Pil.) Parm.), the *Auriscalpiaceae* Maas G., *Gloeocystidiellum* s.l. (*Gloeocystidiellaceae*), the *Hericiaceae* Donk, the *Lachnocladiaceae* Reid (if including the *Dichostereaceae* Jül.), the agaric genus *Lentinellus* Karst. (*Lentinellaceae* Kotl. & Pouz.), the *Stereaceae* Pil., and some poroid genera (*Wrightoporiaceae* Jül.). After analysis of characteristics of above-mentioned groups, *Gloeocystidiellum* s.l. is herein treated in the family *Auriscalpiaceae*. A tentative scheme of subdivisions of the *Auriscalpiaceae* is proposed below.

***Auriscalpiaceae* Maas G.**

***Aleurodiscoideae* (Pil.) Parm.:** Monomitic, hemidimitic or dimitic. Fruit body resupinate, or quite often effused-reflexed. Usually catagymenium. Gloeocystidia SA+ or SA-. Basidia and basidiospores usually fairly large. -- *Acanthobasidium* Oberw., *Acanthophysium* (Pil.) Cunn., *Aleurobotrys* Boid., *Aleurocystidiellum* Lemke, *Aleurodiscus* Rabenh.

Auriscalpioideae: Dimitic. Fruit body stipitate-pileate. Hymenial surface hydroid or lamellate. Gloeocystidia or gloeoplerous hyphae SA+. --

Auriscalpium S.F. Gray, *Lentinellus* Karst.

Gloeocystidielloideae Parm.: Monomitic or hemidimitic. Fruit body resupinate. Hymenial surface usually smooth, rarely odontoid. Gloeocystidia usually SA+. -- *Amylosporomyces* Rattan, *Boidinia* Stalpers & Hjortst., *Conferticium* Hallenb., *Gloeocystidiellum* Donk, *Gloeodontia* Boid., *Gloeomyces* S.H. Wu, *Gloiothele* Bres., *Laxitextum* Lentz, *Pseudoxenasma* Larss. & Hjortst., *Scytinostromella* Parm.

Hericioideae: Monomitic or hemidimitic. Fruit body resupinate, effused-reflexed, pileate, clavate or clavarioid. Hymenial surface distinctly hydroid (clavate and clavarioid genera exceptional). Gloeocystidia or gloeoplerous hyphae usually SA-. -- *Artomyces* Jül., *Clavicornia* Corner, *Creolophus* Karst., *Dentipellis* Donk, *Dentipratulum* Domański, *Gloiodon* Karst., *Hericium* Pers., *Mucronella* Fr., *Stecchericium* S.F. Gray.

Stereoidae Ulbr.: Monomitic or hemidimitic. Fruit body resupinate, effused-reflexed or flabelliform. Hymenial surface smooth. Hyphae without clamps or clamps rare. Acanthophyses or acutophyses present. Gloeocystidia usually present, SA- (*Stereum*) or SA+ (*Xylobolus*). Basidiospores smooth-walled. -- *Stereum* Pers., *Xylobolus* Karst.

Wrightoporioidae: Monomitic, hemidimitic or dimitic. Fruit body resupinate, effused-reflexed, pileate or stipitate-pileate. Hymenial surface poroid. Gloeoplerous hyphae SA+ or SA-. -- *Amylosporus* Ryv., *Wrightoporia* Pouz. (if including *Amylonotus* Ryv.) ("?" *Albatrellus* S.F. Gray, "?" *Anomoporia* Pouz., "?" *Heterobasidion* Bref., "?" *Jahnoporus* Nuss).

Three new subfamilies are proposed in this study:

Auriscalpioideae S.H. Wu, subfam. nov.

Lignicola. Basidiocarpum stipitato-pileatum. Superficies hymenialis hydnoidea vel lamellata. Systema hypharum dimiticum. Gloeocystidia vel gloeohyphae SA+. Basidiosporae verrucoso-aculeatae, IKI lividae.

Typus: *Auriscalpium* S.F. Gray, Nat. Arrang. Brit. Pl. 1:650. 1821.

Hericioideae S.H. Wu, subfam. nov.

Lignicola. Basidiocarpum resupinatum, effuso-reflexum, pileatum, clavatum, vel clavarioideum. Superficies hymenialis hydnoidea (genera clavata et clavarioidea rara). Systema hypharum monomiticum vel imperfecte dimiticum. Gloeocystidia vel gloeohyphae fere SA-. Basidiosporae verrucoso-aculeatae, IKI lividae.

Typus: *Hericium* Pers. ex S.F. Gray, Nat. Arrang. Brit. Pl. 1:652. 1821.

Wrightoporioidae S.H. Wu, subfam. nov.

Lignicola. Basidiocarpum resupinatum, effuso-reflexum, pileatum vel stipitato-pileatum.

Superficies hymenialis poroidea. Systema hypharum monomiticum, hemidimiticum vel dimiticum. Gloeohyphae SA+ vel SA-. Basidiosporae verrucoso-aculeatae, IKI lividae.

Typus: *Wrightoporia* Pouz., Česka Mykol. 20:173. 1966.

Characters currently used by mycologists for the taxonomy of these groups, are mostly morphological and these are not sufficient for final decisions in systematics. The proposed family and subfamily system is constructed following comprehensive consideration. This scheme can be used for further testing, according to new results obtained from molecular and ultrastructural studies in future. In arranging the subfamilies of the Auriscalpioideae, additional explanations are provided as follows.

After detailed studies of macro- and microscopic characters, Maas Geesteranus (1963) concluded that the agaric genus *Lentinellus* is close to *Auriscalpium*, and he proposed the family Auriscalpioideae to accommodate these two genera and also *Gloiodon*. This arrangement has been accepted, e.g., by Donk (1964) and Singer (1986). Results from molecular sequence data (Hibbett 1994) indicated that *Auriscalpium* and *Lentinellus* are monophyletic. Donk (1964) established the Hericiaceae in contrast to the Auriscalpioideae by accommodating species with a monomitic hyphal system and SA- gloeocystidia. The dimitic nature of the hyphal system of *Gloiodon* was questioned, for example by Maas Geesteranus (1963). Thus the subfamily Auriscalpioideae is here confined to stipitate taxa: *Auriscalpium* and *Lentinellus*, while *Gloiodon* is placed in the Hericioideae.

The genus *Gloeodontia* was proposed by Boidin (1966a), and he placed this genus in the family Auriscalpioideae because type species, *G. discolor* (Berk. & Curt.) Boid., has a dimitic hyphal system and SA+ gloeocystidia. *G. columbiensis* Burt ex Burdsall & Lombard was reported by Burdsall & Lombard (1976) to be monomitic. However, after studying specimens of these two species, I regard their hyphal systems as quite similar. For me, the encrusted cystidia of *G. columbiensis* are similar to the normal skeletal cystidia, but with restricted length. Nevertheless, skeletal can be developed in many evolutionary lines. *Gloeodontia* is herein placed in *Gloeocystidielloideae* instead of *Auriscalpioideae*, because the latter is considered to be limited to stipitate and strictly dimitic species.

The Clavicornaceae Corner was erected based on *Clavicornia* s.l. (Corner 1970). This family was accepted, for example by Jülich (1981). However, Donk (1971) discussed the resemblance between *Clavicornia* and *Hericium*. As a result, *Clavicornia* (also *Artomyces*) is presently placed in the Hericioideae. In addition, Donk (1971) regarded *Mucronella* as a strongly reduced form of *Hericium*, and noted that the finding of *Dentipratulum* (Domański 1965) links *Hericium* and *Mucronella*. Fruit bodies in the Hericioideae are fairly variable, but with hydroid tendencies for the hymenial surfaces. Members of this subfamily usually have SA- gloeocystidia. Macroscopically, it was interesting to find (Miller & Stewart 1971) that in cultures of *Lentinellus cochleatus* clavarioid sporophores developed at low temperatures. Microscopically, the hyphal system and gloeocystidium

sulfo-reaction are not sufficient characters for differentiating between families. Ultrastructural studies performed by Capellano & Keller (1978), indicated that there are no differences in basidiospore architectures between members of the "Auriscalpiaceae" and the "Hericiaceae". Based on these reasons, the Auriscalpiaceae and Hericiaceae are thus regarded as the same family.

The Corticiaceae s.l. was earlier encompassed within the Thelephoraceae s.l. After segregation of many families from the Thelephoraceae s.l. in recent decades, the Corticiaceae has become a residual group, due to lacks of distinctive features. Nowadays the Corticiaceae is still a heterogeneous entity with numerous genera and species. Parmasto (1994) cladistically studied genera of the Corticiaceae s.l., and concluded that it is a paraphyletic group. He also suggested that the classification of this group is only reasonable when non-corticioid genera are also included. *Aleurodiscus* s.l. (in the Aleurodiscoideae here) has often been treated in the Corticiaceae, but it also has gloeocystidia and amyloid spores in common with *Gloeocystidiellum* s.l. Moreover, members of *Acanthophysium* (or the synonym: *Acanthophysellum* Parm., in Aleurodiscoideae here) have been regarded as intermediate between *Aleurodiscus* and *Gloeocystidiellum* s.l. (e.g., Eriksson & Ryvarden 1975). The Aleurodiscoideae should be isolated from the Corticiaceae and is moved, together with some other groups which also have gloeocystidia and amyloid basidiospores, to the Auriscalpiaceae.

The Stereoiaceae as used here has the same concept as the well known Stereaceae but reduced in rank. Concept of the "Stereaceae" is not consistent among mycologists, and many genera have been customarily accepted in this group because superficially they have stereoid fruit bodies and skeletal hyphae (e.g., *Lopharia* Kalchbr. & McOwan). *Stereum* is regarded by many mycologists (e.g., Boidin et al. 1979, Eriksson et al. 1984) as dimitic because of its "pseudocystidia" with long and thick-walled skeletal-like basal parts. To me, the "pseudocystidia" represent a modified form of gloeocystidia. The finding of a "monomitic" species bearing fairly typical gloeocystidia (*S. wakullum*) as reported in appendix of this paper, may explain this. Recognition of hyphal system in *Stereum* is thus rather subjective. I prefer to consider this genus as hemidimitic, because the skeletal-like structures are usually dominant in the context of *Stereum*. The family name Stereaceae has long been used, but in my opinion mainly due to tradition. I would like to treat it under the Auriscalpiaceae, because all features are within the concept of the latter.

Jülich (1981) erected the Wrightoporiaceae under the Hericiales. Though *Wrightoporia* exhibits dextrinoid skeletal hyphae, like those in the Lachnocladiaceae, it lacks the utriform basidia of the latter. Dextrinoid skeletal hyphae can be found in many polypore genera, indicating that this feature developed separately for many groups. The Lachnocladiaceae is herein considered to be separate from the Auriscalpiaceae because it is uniformly characterized by branched and dextrinoid skeletal hyphae (or asterosetae) and utriform basidia.

The presence of gloeocystidia (or gloeoplerous hyphae) and amyloid

basidiospores are important features in recognizing the Auriscalpiaceae. However, loss of either gloeocystidia (or gloeoplerous hyphae) or amyloid basidiospores in some members can be found (e.g., *Amylosporomyces*, *Clavicornia* s.s., *Mucronella*). The acceptance of them in the Auriscalpiaceae is based on other combined features. However, sufficient evidence is needed in searching additional amyloid-spored or gloeocystidium-exhibiting members (e.g., *Amylostereum* Boid., *Echinodontium* Ell. & Ev., *Gloeohypochnicium* (Parm.) Hjortst., *Laurilia* Pouz.) for the Auriscalpiaceae.

At a higher rank, where do the Auriscalpiaceae and Lachnocladiaceae belong? An answer of Aphyllophorales seems to be far from satisfactory. Donk (1971) probably was the first to discuss the possibility of connecting the Russulales to some groups in the Aphyllophorales possessing gloeoplerous hyphae and amyloid spores. Since then, very few mycologists (e.g., Oberwinkler 1977, Redhead & Norvell 1993) have mentioned this possibility, mostly because the Russulales has long been treated in the agaric group. Is it possible that long ago a branch of the Russulales evolved as lignicolous organisms and that the Auriscalpiaceae and Lachnocladiaceae are two groups on this branch? New evidence based on molecular and ultrastructural studies may aid further consideration of this possibility and also may help with arrangement of subdivisions of the Auriscalpiaceae.

MATERIALS AND METHODS

Materials for this study were collected in Taiwan from various localities during 1988-1994. For interpretation of collection data such as altitudinal zones, vegetation, and names of administrative areas, refer to Wu (1990). The general methods for dealing with specimens and examination of specimens, and general terms used for describing various characters, have also been explained by Wu (1990). Some amendments and additional methods and terms are detailed below. All studied specimens, as well as fungal cultures, are deposited at the herbarium of National Museum of Natural Science of ROC (abbreviated as N.M.N.S.). Some duplicate specimens including isotypes will be distributed to other herbaria. The abbreviations of herbaria follow Holmgren et al. (1990). Color names used for describing fruit bodies are from Kornerup & Wanscher (1978).

Observations and measurements of basidiospores

In *Gloeocystidiellum* s.l., basidiospore ornamentation is retained when material is mounted in Melzer's reagent (IKI) but the ornamentation disappears in KOH. In this study definitions for describing ornamentation of spore surfaces follow Larsson (1994). Accordingly, "aculeate" is defined as having blunt processes of length/width > 1 , and $l/w \leq 1$ for "verrucose". To ensure accurate use of the terms, SEM observations were performed. Dried specimens attached to

stubs were coated with gold, and were observed under SEM (HITACHI Model S-570) at 20 kV. Measurements of basidiospore lengths and widths are based on the side view -- adaxial and abaxial sides. Apiculi and ornamentation are excluded in spore measurements. Only spore-prints (abbreviated as **SPR**) were used for the purpose of statistical analyses, because spores from SPR can be regarded as mature. Spores adhering to the hymenial surface may be immature, and choice of spores for measurement is fairly subjective. In this study, I have decided to use 5 % KOH as the standard mounting medium for all measurements. This medium is widely accepted for measurement of corticioid and other basidiomycetes, to ensure that spores have rehydrated. Some mycologists use IKI as the mounting medium for observation and measurement of *Gloeocystidiellum* s.l. basidiospores because it reveals the ornamentation of the spore surface. Some reported spore measurements may be larger than my measurements from the same material, if spore ornamentation was included in the former. But in studying this group most authors did not mention which kind of mounting medium they used for measuring basidiospores, and whether they have included ornamentation in measurements. Therefore confusion may arise in comparisons. However, IKI is mainly used for detecting amyloidity and dextrinoidity, rather than for spore measurements. The problem becomes more serious if measurements are made from diversified groups or fungal flora; how is one to know whether spore measurements are made in IKI or in KOH without indication. One exception is the study of Ginns & Freeman (1994), where ornamentation is not included in the sizes of the basidiospores (evidently in KOH). Therefore the measurements by Ginns & Freeman are comparable.

Cultural and cytological studies

Cultures of the studied group were obtained in two ways. First, from isolation of mycelium in the wood beneath the fruit body. Because corticioid basidiomycetes have fairly thin fruit bodies it is very difficult to obtain cultures from fruit body internal tissue. The mycelium in the wood is regarded as the same as that from fruit body, and designated as fruit body mycelium (abbreviated as **FB-mycelium**). Secondly, by sequential dilutions of spores from spore-prints, poured on MEA plates. Several days later, monosporous mycelia and polysporous mycelia are isolated following germination of spores. In this study, monosporous mycelium is abbreviated as **MS-mycelium** and polysporous mycelium as **PS-mycelium**. In many cases cultural studies were performed based on secondary mycelium (as **SC-mycelium**) derived from two compatible MS-mycelium. Though FB-mycelium is often originated from SC-mycelium, it is better to have separate terms in distinguishing them.

Cultural description methodology and cultural codes are basically from Nobles (1965) with amendments by Boidin and Lanquetin (1983). Minor modifications to Nobles' codes have been presented by some other authors (e.g., Chamuris 1986). The methods and code system detailed by Nakasone (1990) is

comprehensive. Following Nakasone the mycelia were grown on 1.5 % MEA instead of 1.25 % MEA, and incubation of cultures was at 25 °C instead of "room temperature". I inverted plates to avoid accumulation of water from the mycelium. Inverted plates permit formation of a hymenium oriented as in nature. FB-mycelium, SC-mycelium and PS-mycelium may be used for cultural descriptions and species codes. In MEA cultures macroscopic features were described each week until the mycelia covered the plate. Both macroscopic and microscopic features were described after 6 weeks of growth. Gallic acid agar (GAA) and tannic acid agar (TAA) were used to test for laccase, and tyrosine agar (TYA) was used to detect tyrosinase. The methods for preparing these agars and the expression of the reactions are described by Nakasone (1990). Different sources of gallic and tannic acid will give consistent oxidase reactions but variable growth rates (Nakasone 1990). In this study these acids were analytical grade from "Fluka". The drop tests recommended by Marr (1979) for laccase and tyrosinase were also used as a comparison.

MS-mycelia were used for determination of sexuality of single-clamped species. Eight to 10 MS-mycelia were crossed in pairs in all combinations, the inocula separated by a distance of 1-2 cm. Four weeks after contact, the presence of normal clamped hyphae from the zone of confrontation indicates compatibility. Compatibility between two groups of MS-mycelia indicates bipolar heterothallism of the specimen. In this case, crossings among the same mating type should be incompatible. The crossing response for a tetrapolar heterothallic organism is more complicated. For common AB ($A=B=$) and common A ($A=B\neq$) crossings, no clamped hyphae can be found in the zone of confrontation. Normal clamped hyphae are present for the non-common AB ($A\neq B\neq$) case. False-clamped hyphae can be found from the zone of confrontation of common B ($A\neq B=$) crossings. The presence of clamped hyphae in all MS-mycelia indicates homothallism.

For distinguishing "biological species" between closely related species, compatibility tests were performed by crossing a dikaryotic mycelium with a haploid mycelium of another specimen, the latter surrounding the dikaryon on the plate. After four weeks of contact, dikaryotization of the haploid mycelium (as evidenced by the formation of clamped hyphae) indicates intercompatibility. The haploid mycelia used for compatibility tests must show fertile capability, usually sourced from the identified "polarities" in sexuality studies. Nuclear staining with Giemsa followed the method of Boidin (1958). Fluorescent stains for nuclei were additionally used. DAPI (4'-6'-diamidino-2-phenylindole) was found to be effective in this study at a concentration of 0.25 µg/ml. Terminology for nuclear behavior is based on Boidin & Lanquetin (1984).

Key to genera of *Gloeocystidiellum* s.l. of Taiwan

1. Dimitic. Binding hyphae present in subiculum *Gloeomyces*
1. Monomitic. Binding hyphae absent in subiculum 2

2. Basidia suburniform. Basidiospore walls ornamented *Boidinia*
2. Basidia clavate. Basidiospore walls ornamented or smooth 3
3. Basidiome context with cyanophilous and clampless hyphae. Basidia repetitive.
Nuclear behavior holocoenocytic..... *Conferticum*
3. Not as above 4
4. Basidiospore walls ornamented *Gloeocystidiellum*
4. Basidiospore walls smooth or almost so 5
5. Hyphae simple-septate. Basidiospores broadly ellipsoid to globose. Nuclear behavior
subnormal *Gloiothele*
5. Hyphae nodose-septate. Basidiospores ellipsoid to suballantoid. Nuclear behavior
heterocytic *Megalocystidium*

Boidinia Stalpers & Hjortst. in Hjortst. & Stalpers, Mycotaxon 14:76. 1982.

Fruit body resupinate, effuse, farinose-porose, membranaceous or subceraceous. Hymenial surface smooth or grandinoid.

Hyphal system monomitic; hyphae nodose- or simple-septate. Subiculum fairly uniform, with dense or loose texture. Subhymenium more or less thickening. Gloeocystidia numerous, SA+. Basidia suburniform, normally 4-sterigmate. Basidiospores subglobose to cylindrical, usually with a distinct apiculus, aculeate to verrucose (smooth in KOH), thin- or slightly thick-walled, IKI bluish black, CB-.

Remarks: The genus *Boidinia* is separated from other genera of *Gloeocystidiellum* s.l., by the combination of suburniform basidia and ornamented basidiospores. Both clamped and clampless species are present in this genus. *Scytinostromella* Parm. is allied to *Boidinia*, but with branched "skeletal" in the subiculum.

Key to species of *Boidinia*

1. Basidiospores > 10 µm long *B. macrospora*
1. Basidiospores < 10 µm long 2
2. Encrusted cystidia present *B. inconstans*
2. Encrusted cystidia lacking 3
3. Hyphae nodose-septate 7
3. Hyphae simple-septate 4
4. Basidiospores > 4.5 µm long 6
4. Basidiospores < 4.5 µm long 5
5. Temperate sp. Basidiome pale yellow. Basidiospores with a distinct oily
drop *B. propinqua* (Jacks. & Deard.) Hjortst. & Ryv.
5. Subtropical sp. Basidiome gray. Basidiospores with fairly homogeneous contents
..... *B. cana*
6. Basidiospores > 4 µm broad *B. laticolor* (Bres.) Hjortst. & Ryv.
6. Basidiospores < 4 µm broad *B. peroxydata* (Rick) Hjortst. & Ryv.

7. Basidiospores $> 5 \mu\text{m}$ broad *B. furfuracea* (Bres.) Stalpers & Hjortst.
 7. Basidiospores $< 5 \mu\text{m}$ broad 8
 8. Hymenial surface granuloid *B. granulata*
 8. Hymenial surface smooth 9
 9. Subiculum loose. Basidiospores subglobose, mostly $> 3.5 \mu\text{m}$ broad *B. luteola*
 9. Subiculum dense. Basidiospores reniform, $< 3.5 \mu\text{m}$ broad *B. subasperispora*

The species of *Boidinia* recorded from Taiwan are *B. cana*, *B. granulata*, *B. luteola* and *B. macrospora*.

***Boidinia cana* S.H. Wu, sp. nov. (Figs. 1, 24A-B & 26A)**

Basidiocarpum resupinatum, effusum, submembranaceo-pruinose, 30-60 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae efibulatae. Gloeocystidia numerosa, 18-30 $\times$ 5-10 μm , SA+. Basidia suburniformae, 12-16 $\times$ 3.5-4.5 μm , 4 sterigmatibus. Basidiosporae subglobosae, aculeatae, tenuitunicatae vel exigue crassitunicatae, 3.6-4.1 $\times$ 3-3.5 μm , IKI lividae, CB-.

Holotypus: Taiwan. Taoyuan: Shanshia, alt. 280 m, on branch of angiosperm, 9.IX.1988, Wu 880909-41 (N.M.N.S.).

Etyymology: From canus (= gray), referring to the color of the fruit body.

Fruit body resupinate, effuse, adnate, submembranaceous-pruinose, 30-60 μm thick in section. Hymenial surface "grey" (2B1), smooth, rarely cracked; margin thinning.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, with dense texture; hyphae $\pm$ horizontal near substratum, fairly distinct, hyaline or subhyaline, 2-4 μm diam, thin- or slightly thick-walled. Subhymenium not clearly differentiated from subiculum. Gloeocystidia numerous, immersed or emergent, hyaline, usually basally swollen and with narrow apices, rarely clavate, containing yellow and shiny oily contents, 18-30 $\times$ 5-10 μm , thin- or slightly thick-walled, SA+. Basidia suburniform, 12-16 $\times$ 3.5-4.5 μm , 4-sterigmate. Basidiospores subglobose, with a distinct apiculus, aculeate (smooth in KOH), thin- or slightly thick-walled, 3.6-4.1 $\times$ 3-3.5 μm , with fairly homogeneous contents, IKI bluish black, CB-.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Cultural description (FB-mycelium of holotype):

1 wk growth: Colony radius 23-26 mm. Advancing zone fimbriate. Mats white. Aerial mycelium almost absent. 2 wk growth: Colony radius 55-65 mm. Advancing zone fimbriate. Mats white. Aerial mycelium sparsely pellicular, with numerous separate whitish granules. 3 wk growth: Plate covered. 6 wk growth: Colony covered. Mats white. Aerial mycelium sparsely pellicular, with numerous separate whitish granules. Hyphal system monomitic; hyphae simple-septate. Aerial hyphae hyaline to yellow, fairly distinct, sparsely or moderately ramified, guttulate, 1-5 μm diam, thin-walled; gloeoplerous hyphae numerous, morphologically indistinguishable from the normal

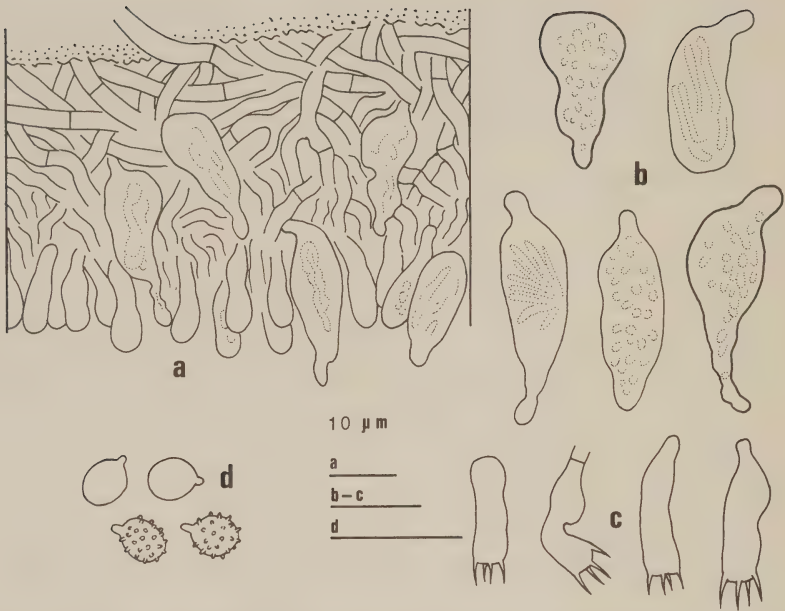


Fig. 1. *Boidinia cana* (holotype). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (upper in KOH; lower in IKI).

hyphae, thin-walled, SA+. Submerged hyphae similar to aerial hyphae, but lacking the yellow ones and gloeoplerous ones. Cubical crystals present. Odor slightly sweet. Not fruiting.

Oxidase reactions:

Synergaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++, 0; 0. GAA: +++, tr; 15-20. TYA: -, 20; 35.

Species code:

2a, 6, 15a, 32, 36, 38, 43, 50, 54, 64.

Cytology: FB-mycelium dikaryotic.

Remarks: Four characteristics can be used to distinguish *Boidinia cana* from the closely related *B. propinqua*. The fruit body of *B. propinqua* is pale yellow, while that of *B. cana* is gray. Gloeocystidia of *B. propinqua* are much longer than those of *B. cana*, and the shape is cylindrical, not basally swollen and apically narrow as in *B. cana*. Basidiospores of *B. propinqua* are slightly smaller ($3.3-4 \times 2.7-3.2 \mu\text{m}$, from holotype), and have a distinct oil-drop which is not present in those of *B. cana*. Furthermore, *B. propinqua* was found in Canada and USA (Hjortstam & Ryvarden 1988), while *B. cana* is known from subtropical Taiwan.

Boidinia granulata S.H. Wu, sp. nov. (Figs. 2, 24C-E & 26B)

Basidiocarpum resupinatum, effusum, membranaceum vel subceraceum, 30-200 μm crassum; superficies hymenialis minute aculeata. Systema hypharum monomiticum; hyphae fibulatae. Gloecystidia numerosa, cylindrica, 8-18 μm diam, SA+. Basidia suburniformae, 13-18 $\times$ 3.5-4 μm , 4 sterigmatibus. Basidiosporae late ellipsoideae vel subgloboseae, verrucosae, tenuitunicatae, 3.9-4.8 $\times$ 2.9-3.5 μm , IKI lividae, CB-.

Holotypus: Taiwan. Taipei: Roadside of highway between Hsintien and Pinglin, alt. 300 m, on branch of angiosperm, 27.IV.1991, Wu 910427-21 (N.M.N.S.; isotypus: GB).

Etymology: From *granulatus* (= granular), referring to the hymenial surface of this species.

Fruit body resupinate, effuse, adnate, membranaceous or subceraceous, 30-200 μm thick in section (aculei included). Hymenial surface "pale yellow" (4A3) to "yellowish white" (3A2), minutely or indistinctly grandinioid or aculeate, rarely cracked; margin concolorous, thinning, pruinose. Aculei usually small, separate or fused, fairly irregular in densities and sizes.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of medullary layer, with dense texture; hyphae hyaline, variously oriented, fairly tortuous and indistinct, occasionally glued together, 1.5-3 μm diam, thin-walled. Subhymenium thickening, not differentiated from subiculum, with compact texture; hyphae hyaline, indistinct, somewhat narrower than those in subiculum. Gloecystidia numerous, immersed or slightly emergent, hyaline or subhyaline, cylindrical, basally swollen and apically narrow, $\pm$ flexuous, up to ca. 100 μm long, 8-18 μm diam, SA+. Crystal masses sometimes scattered or crowded in subiculum, usually crowded in trama. Basidia suburniform, 13-18 $\times$ 3.5-4 μm , 4-sterigmate. Basidiospores broadly ellipsoid or subglobose, adaxially flattened, verrucose (smooth in KOH), with a distinct apiculus, thin-walled, usually with oily drops, 3.9-4.8 $\times$ 2.9-3.5 μm (Chen 147 SPR: $4.20 \pm 0.22 \times 3.12 \pm 0.17 \mu\text{m}$, $n = 30$), IKI bluish black, CB-.

Additional specimens examined: Taiwan. Ilan: Fushan Nature Reserve, alt. 600 m, on branch of angiosperm, 3.IX.1992, Wu 9209-34 (N.M.N.S.); Yuienyanghu, alt. 1650 m, 8.III.1994, Chen 147 (K, H, N.M.N.S.).

Distribution: Known only from Taiwan.

Cultural description (FB-mycelium of Wu 9209-34):

1 wk growth: Colony radius 10-17 mm. Advancing zone fairly even. Mats white. Aerial mycelium pellicular or downy. 2 wk growth: Colony radius 30-45 mm. Advancing zone even. Mats white. Aerial mycelium downy. 3 wk growth: Colony radius 55-70 mm. Advancing zone even. Mats white. Aerial mycelium downy-pellicular. 4 wk growth: Plate covered. 6 wk growth: Mats whitish. Aerial mycelium almost absent or slightly pellicular. Hyphal system monomitic. Hyphae nodose-septate, hyaline, moderately or sparsely ramified, occasionally inflated irregularly, usually guttulate, 2-5 μm diam, thin-walled. Cubical crystals present. Odor fragrant. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: -, 0; 0. GAA: +++, 0; 0. TYA: -, 40-45; 90+.

Species code:

2a, 3c, 7, 32, 36, 38, 44, 50, 54, 59, 61.

Sexuality (Chen 147): bipolar (A₁: 1, 4, 9; A₂: 3, 5, 7, 8, 10).

Cytology (Chen 147): Spores uninucleate, MS-mycelium uninucleate, SC-mycelium dikaryotic.

Nuclear behavior: Normal.

Remarks: In *Boidinia*, this new taxon is the only species with an aculeate hymenial surface, even though the aculei are fairly tiny.

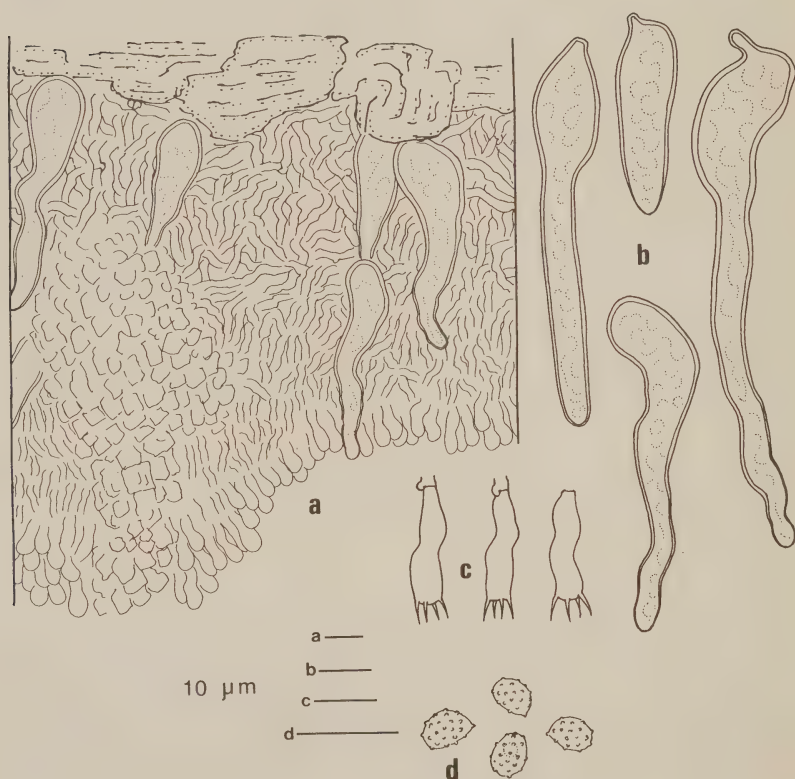


Fig. 2. *Boidinia granulata* (holotype). a) Fruit body section, b) gloecystidia, c) basidia, d) basidiospores (in IKI).

Boidinia luteola S.H. Wu, sp. nov. (Figs. 3 & 24F)

Basidiocarpum resupinatum, effusum, membranaceum, 40-100 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Gloeocystidia numerosa, cylindrica vel tubularia, 35-70 $\times$ 5-10 μm , SA+. Basidia suburniformae, 14-18 $\times$ 4-5 μm , 4 sterigmatibus. Basidiosporae subglobosae, aculeatae, tenuitunicatae, 4.2-5.2 $\times$ 3.3-3.8 μm , IKI lividae, CB-.

Holotypus: Taiwan. Nantou: Yushan National Park, entrance of Salishienshilindao near Tungpu, alt. 1350 m, on culm of *Miscanthus floridulus*, 24.XI.1993, Wu 9311-70 (N.M.N.S.; isotypus: GB).

Etymology: From luteolus (= pale yellow), referring to the color of the fruit body.

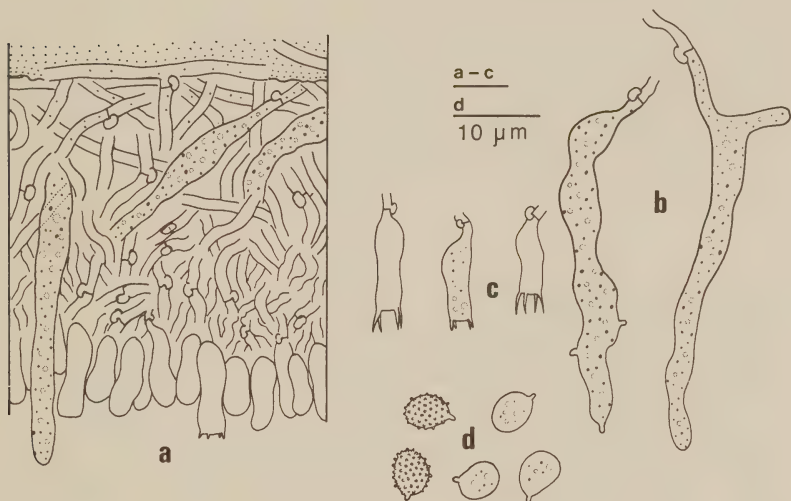


Fig. 3. *Boidinia luteola* (holotype). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (left: in IKI; right: in KOH).

Fruit body resupinate, effuse, adnate, membranaceous or submembranaceous, 40-100 μm thick in section. Hymenial surface "yellowish white" (3A2), smooth, sometimes cracked; margin concolorous, thinning, filamentose-pruinose.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, with fairly loose texture; hyphae $\pm$ horizontal next to substratum, variously oriented elsewhere, hyaline, 1.5-3 μm diam, thin-walled. Subhymenium slightly thickening, not clearly differentiated from subiculum, with denser texture; hyphae hyaline, thin-walled. Gloeocystidia numerous, emergent or immersed, subhyaline,

yellowish or brownish yellow, cylindrical or tubular, somewhat flexuous, with stalked bases, quite often developed laterally from the supporting hyphae, occasionally with apical or lateral projection(s), $35\text{--}70 \times 5\text{--}10 \mu\text{m}$, thin- or slightly thick-walled, SA+. Basidia suburniform, $14\text{--}18 \times 4\text{--}5 \mu\text{m}$, 4-sterigmate. Basidiospores subglobose, aculeate (smooth in KOH), thin-walled, usually with several small oil-drops, $4.2\text{--}5.2 \times 3.3\text{--}3.8 \mu\text{m}$, IKI bluish black, CB-.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Remarks: This new species resembles *Boidinia peroxydata*, especially by the sizes of basidiospores, but the latter is a clampless species.

***Boidinia macrospora* S.H. Wu, sp. nov. (Figs. 4, 25J & 26C)**

Basidiocarpum resupinatum, effusum, subceraceum, $30\text{--}100 \mu\text{m}$ crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Gloeocystidia numerosa, cylindrica, $20\text{--}55 \times 8\text{--}12 \mu\text{m}$, SA+. Basidia utriformae, $22\text{--}35 \times 6\text{--}7 \mu\text{m}$, 4 sterigmatibus. Basidiospores cylindricae, confuse verrucosae, tenuitunicatae, $(11\text{--}) 11.5\text{--}13.5 \text{--}(14) \times 4\text{--}5.2 \text{--}(5.8) \mu\text{m}$, IKI lividae, CB-.

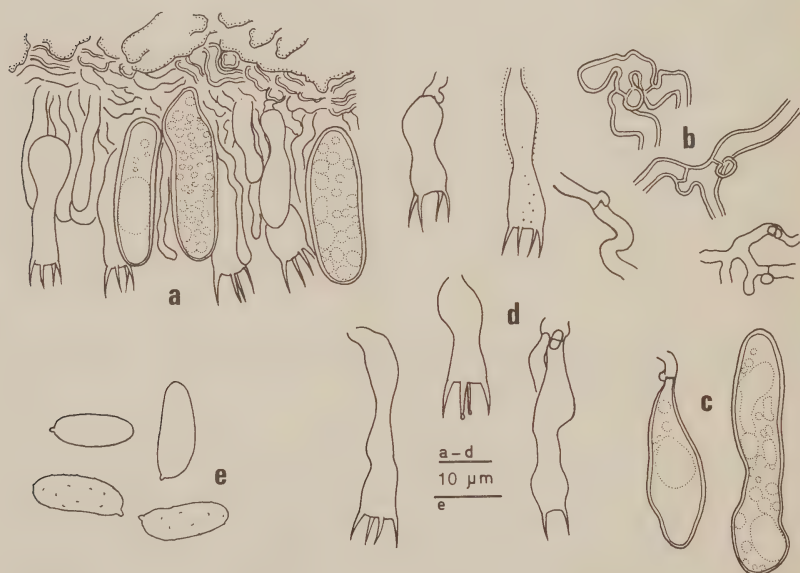


Fig. 4. *Boidinia macrospora* (holotype). a) Fruit body section, b) subicular hyphae, c) gloeocystidia, d) basidia, e) basidiospores (upper: in KOH; lower: in IKI).

Holotypus: Taiwan. Pingtung: Kengting National Park, Chufengshan, alt. 200 m, on branch of angiosperm, 20.II.1992, Wu 9202-21 (N.M.N.S.).

Etymology: From macro (= big) + sporus (= spore), referring to the dimensions of the basidiospores.

Fruit body resupinate, effuse, adnate, subceraceous, 30-100 μm thick in section. Hymenial surface "pale yellow" (4A3) to "yellowish white" (4A2), smooth, extensively cracked; margin concolorous, thinning, pruinose.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, thin and sometimes indistinct, with compact texture; hyphae mainly horizontal, hyaline, sometimes indistinct, 1.7-4 μm diam, with fairly thin to ca. 1 μm thick walls. Subhymenium thin or indistinct, not clearly differentiated from subiculum. Gloeocystidia numerous, emergent or immersed, mostly hyaline, cylindrical, sometimes slightly flexuous, apically obtuse, $20\text{--}55 \times 8\text{--}12 \mu\text{m}$, with 0.5-2 μm thick walls, SA+. Basidia utriform or suburniform, $22\text{--}35 \times 6\text{--}7 \mu\text{m}$, 4-sterigmate. Basidiospores cylindrical, indistinctly verrucose or seemingly smooth, thin-walled, $(11\text{--}) 11.5\text{--}13.5 \text{--}(14) \times 4.5\text{--}5.2 \text{--}(5.8) \mu\text{m}$ (holotype SPR: $X = 12.51 \pm 0.74 \times 4.65 \pm 0.56 \mu\text{m}$, $n = 30$), IKI bluish black, CB–.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Cultural description (MS- and PS-mycelium of holotype):

1 wk growth: Colony radius 7-12 mm. Advancing zone fairly even. Mats white. Aerial mycelium pellicular-downy. 2 wk growth: Colony radius 16-24 mm. Advancing zone fairly even. Mats white. Aerial mycelium pellicular-downy. 3 wk growth: Colony radius 30-37 mm, Mats white. Aerial mycelium downy-cottony. 4 wk growth: Colony radius 45-55 mm. 5 wk growth: Colony radius 60-72 mm. 6 wk growth: Plate covered. Mats white. Aerial mycelium slightly pellicular, zonate. Hyphal system monomitic; hyphae nodose-septate. Aerial hyphae hyaline, sparsely ramified in wide hyphae, richly ramified in narrow hyphae, usually guttulate, 1-5 μm diam, with thin to irregularly thickened walls. Gloeocystidia occasionally present, tubular or cylindrical, 4-7 μm diam, thin-walled, SA–. Submerged hyphae hyaline, moderately ramified, usually guttulate, 1-5 μm diam, thin-walled. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions (PS-mycelium of holotype):

Syringaldazine (–), 1-Naphthol (–), L-tyrosine (–), p-Cresol (–).

TAA: +++ or ++++, tr; 12. GAA: +++++, tr; tr. TYA: –, tr; 7.

Species code (MS- and PS-mycelium of holotype):

2a, 3c, 9, 15b, 32, 36, 38, 46, 54, 57, 68.

Sexuality: Homothallic (evidenced by nodose-septate hyphae present in all MS-mycelia).

Cytology: Spores binucleate, MS-mycelium dikaryotic, PS-mycelium dikaryotic.

Nuclear behavior: holodikaryotic.

Remarks: This new species is characterized by the large basidia and basidiospores, the latter cylindrical and indistinctly ornamented. Most *Boidinia* species have fairly small

basidiospores, which are globose to broadly ellipsoid in shape and fairly distinctly ornamented. This species is also distinct in having homothallic sexuality and holodikaryotic nuclear behavior, this species is rather atypical in the genus *Boidinia*.

Conferticium Hallenb., Mycotaxon 11:447. 1980.

Fruit body resupinate, effuse, membranaceous to ceraceous. Hymenial surface smooth. Hyphal system monomitic; hyphae simple-septate, cyanophilous. Subiculum fairly thin, composed of basal layer, with compact texture. Subhymenium usually thickening, differentiated from subiculum, with compact texture; hyphae mainly vertical. Gloeocystidia numerous, SA+. Basidia clavate, repetitive, 4-sterigmate. Basidiospores ellipsoid, aculeate-verrucose or smooth, thin-walled, with a distinct apiculus, IKI bluish black, CB-. Nuclear behavior holocoenocytic.

Remarks: *Conferticium* is distinguished from other genera of *Gloeocystidiellum* s.l. by a combination of characteristics such as simple-septate hyphae, very dense pseudoparenchymatic context consisting of vertical and cyanophilous hyphae, and the internal basidial repetition. The holocoenocytic nuclear behavior of this genus further reinforces the distinctiveness of this genus.

Key to species of *Conferticium*

1. Basidiospores smooth in IKI *C. ochraceum*
1. Basidiospores ornamented in IKI 2
2. Temperate and warm-temperate - subtropical species. Gloeocystidia quite often > 50 μm long, sometimes apically with a schizopapillate constriction *C. ravum*
2. Subtropical species. Gloeocystidia < 50 μm long, apically without a schizopapillate constriction *C. heimii*

Conferticium heimii (Boid.) S.H. Wu, comb. nov. (Figs. 5, 24G-H & 26D)

Basionym: *Gloeocystidiellum heimii* Boid., Cah. Maboké 4:10. 1966.

= *Gloeocystidiopsis heimii* (Boid.) Jül., Int. J. Myc. Lich. 1:28. 1982.

Fruit body resupinate, effuse, adnate, submembranaceous or membranaceous, 20-55 μm thick in section. Hymenial surface "greyish orange" (5B4) to "light orange" (5A4), smooth; not cracked; margin concolorous or paler, rather determinate, arachnoid or sparsely filamentose.

Hyphal system monomitic; hyphae simple-septate, cyanophilous and dextrinoid. Subiculum uniform, thin and sometimes invisible, with dense texture; hyphae hyaline, occasionally glued together, 2-3 μm diam, thin- or slightly thick-walled. Subhymenium not thickening or only slightly thickening, perhaps due to the still young stage of the specimen. Gloeocystidia numerous, hyaline, cylindrical or clavate, 18-33 $\times$ 4-6.5 μm , thin- or slightly thick-walled, slightly SA+, sometimes indistinguishable from basidioles in shape. Basidia clavate, 17-

$27 \times 4.5-6 \mu\text{m}$, usually with thickened walls at the base, 4-sterigmate. Basidiospores broadly ellipsoid, verrucose (smooth in KOH), thin-walled, with a distinct apiculus, (5-) $5.3-6.2$ (-6.5) $\times$ (3.2-) $3.5-4.2$ (-4.5) μm (Wu 9209-13 SPR: $X = 5.79 \pm 0.37 \times 3.86 \pm 0.32$, $n = 30$), with fairly homogeneous contents, IKI bluish black, CB-.

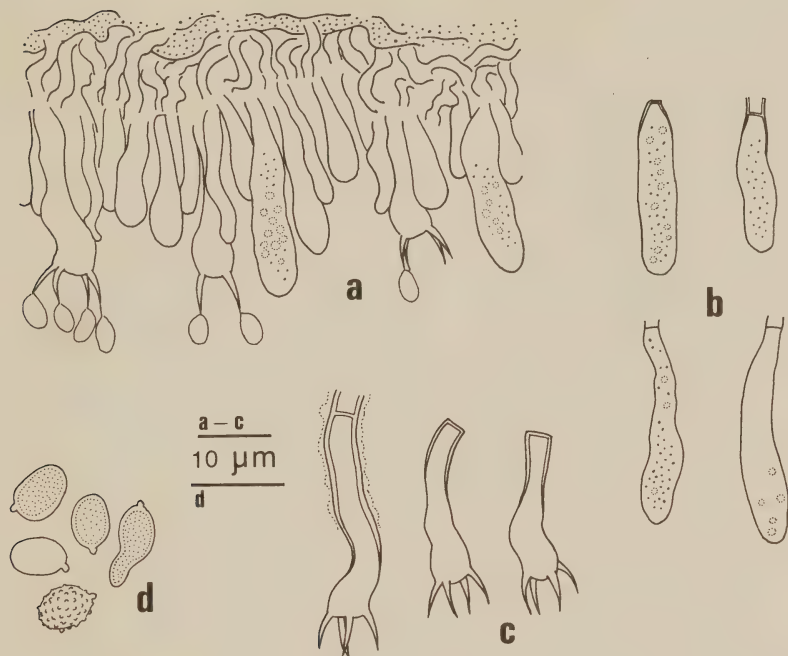


Fig. 5. *Conferticium heimii* (Wu 9209-13). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (upper: in KOH; lower: in IKI).

Specimens examined: Taiwan. Ilan: Fushan Nature Reserve, alt. 600 m, on branch of angiosperm, 3.IX.1992. Wu 9209-13 (N.M.N.S.). Republic of Cental Africa. La Maboké : prè M'Baiki, en lissongo, 25.X.1967, leg. Boidin, LY 6116 (det. by Boidin as *Gloeocystidiellum heimii*).

Distribution: Republic of Central Africa (type locality), Taiwan.

Cultural description (PS-mycelium of Wu 9209-13):

1 wk growth: Colony radius 12-17 mm. Advancing zone fairly even. Mats whitish. Aerial mycelium almost absent. 2 wk growth: Colony radius 33-43 mm. Advancing zone even. Mats white. Aerial mycelium almost absent. 3 wk growth: Colony radius 53-65 mm. Advancing zone even. Mats white, sparse. Aerial mycelium absent. 4 wk growth: Plates partly covered. 6 wk growth: Mats white. Aerial mycelium absent. Hyphal system monomitic. Hyphae mostly simple-septate, rarely with single clamped to multiclamped septa in wide hyphae, distinct, moderately ramified, 1.5-4 μm diam, thin-walled. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++++, tr; 13. GAA: +++++, 0; 0. TYA: -, 25; 45.

Species code:

2a, 5, 7, 32, 36, 38, 44-45, 54, (57), 66.

Sexuality: Presumed homothallic.

Cytology: Spores binucleate, MS-mycelium multinucleate, PS-mycelium multinucleate.

Nuclear behavior: Holocoenocytic.

Remarks: The pseudoparenchymatic thickening subhymenium, typical of the genus, can be found in thicker parts of the fruit body of this species. Basidia of the examined specimens are basally thick-walled and with adhesive material which may indicate internal basidial repetition, a feature of the genus. Moreover, the holocoenocytic nuclear behavior also is diagnostic of *Conferticium*.

This species is similar to *C. ravum*, but several characteristics can be combined to separate them. *Conferticium ravum* has larger gloeocystidia which often have a schizopapillate apical constriction. Basidiospores are slightly longer in *C. ravum*. Moreover, *C. ravum* is a temperate or temperate - subtropical species, while known collections of *C. heimii* are from subtropical zones.

***Conferticium ochraceum* (Fr.:Fr.) Hallenb., Mycotaxon 11:448. 1980. (Fig. 6)**

≡ *Thelephora ochracea* Fr.:Fr., Syst. Mycol. 1:446. 1821.

≡ *Corticium ochraceum* (Fr.:Fr.) Fr., Epicrisis :563. 1838.

≡ *Gloeocystidium ochraceum* (Fr.:Fr.) Litsch. in Bourd. & Galz., Hym. France:266. 1928. It is illegitimate, because is a latter homonym of *G. ochraceum* Bres. 1911.

≡ *Gloeocystidium friesii* Lund. in Lund. & Nann., Fungi Exs. Suec. no. 1851. 1950. It was proposed as a nom. nov. for *G. ochraceum* because the epithet *ochraceum* was occupied by *G. ochraceum* Bres.

≡ *Gloeocystidiellum ochraceum* (Fr.:Fr.) Donk, Fungus 26:9. 1956.

Fruit body resupinate, effuse, adnate, subceraceous or ceraceous, thin to rather thick due to several growth layers (perennial). Hymenial surface smooth, "light yellow" (4A4) when young, "brown" (8E8) when old, extensively and deeply cracked when old; margin rather determinate, concolorous.

Hyphal system monomitic; hyphae simple-septate, cyanophilous and dextrinoid. Subiculum of a thin basal layer or indistinct; hyphae hyaline or subhyaline, 2-4 μm diam, thin- or slightly thick-walled. Subhymenium distinctly

thickening, due to numerous hymenial layers, with very compact texture; hyphae vertical, yellowish brown, 2-3.5 μm diam, with thickened walls. Gloeocystidia numerous, cylindrical or tubular, slightly flexuous, with yellow contents, sometimes difficult to find from old parts, 20-60 $\times$ 5-8 μm , thin- or slightly thick-walled, SA+. Basidia subclavate, 20-30 $\times$ 4-5 μm , with thickened walls toward the basal parts probably because of internal repetition, 4-sterigmate. Basidiospores ellipsoid, smooth, thin-walled, 4.2-5.5 $\times$ 2.8-3.3 μm , IKI bluish black, CB-.

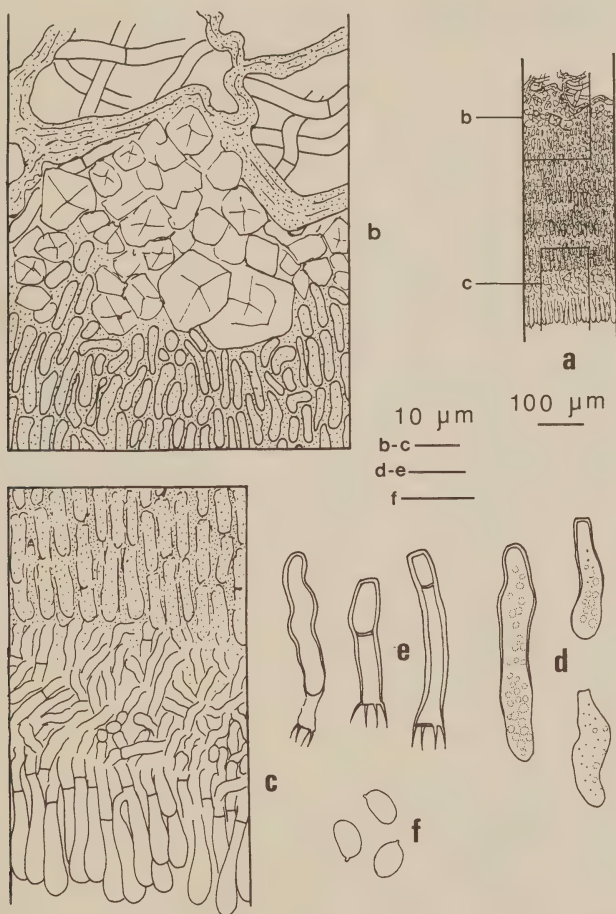


Fig. 6. *Conferticium ochraceum* (Wu 880108-5). a) Fruit body section, b & c) detailed parts of fruit body section, d) gloeocystidia, e) basidia, f) basidiospores.

Specimen examined: Taiwan. Nantou: Yushan National Park, between Kuankao and Patungkuan, alt. 2800-3000 m, on bark, leg. Y.M. Ju, 8.I.1988, Wu 880108-5 (N.M.N.S., TAI).

Distribution: pantemperate.

Cultural studies: See Nakasone (1990).

Sexuality: Presumed homothallic (Boidin 1966b, as *Gloeocystidium friesii*).

Cytology: MS-mycelium multinucleate, PS-mycelium multinucleate (Boidin 1966b, as *G. friesii*).

Nuclear behavior: Holocoenocytic (Boidin 1966b, as *G. friesii*).

Remarks: The separation of *Conferticium ochraceum* from *C. insidiosum* (Bourd. & Galz.) Hallenb. is not yet resolved. *C. insidiosum* was reported to grow on deciduous trees (Freeman 1978, Hjortstam & Ryvarden 1988), while *C. ochraceum* occurs on conifers (Eriksson & Ryvarden 1975, Freeman 1978) but can also be found on deciduous trees (Hjortstam & Ryvarden 1988). These two species have judged to be microscopically inseparable (Freeman 1978, Hjortstam & Ryvarden 1988). According to Bourdot & Galzin (1928), *C. ochraceum* has bigger basidiospores than *C. insidiosum* ($5.6 \times 3.3.5 \mu\text{m}$ for the former, and $3.5 \times 2.3 \mu\text{m}$ for the latter). Nevertheless, Freeman (1978) measured basidiospores of a *C. insidiosum* specimen (collected and determined by Bourdot, no. 300063 at PC) as $4.5 \times 2.5.3 \mu\text{m}$, he also designated neotype (collected by Fries, at S) for *C. ochraceum* and measured its basidiospores as $4.4.5 \times 2.2.5 \mu\text{m}$; both are similar. However, Hjortstam (1987a) designated another specimen (Sweden. Upperland, Uppsala, Vårdsätra, 13 Oct. 1947, leg. Berit & John Eriksson 2317, Fungi exc. succ. no. 1851, as *Gloeocystidium friesii*, deposited at UPS) as neotype of *C. ochraceum*. The designation of Hjortstam was accepted by Ginns & Freeman (1994). Ginns & Freeman (1994) measured basidiospores of North America *C. ochraceum* collections as $3.5.5.5 \times 2.3 \mu\text{m}$. Hjortstam & Ryvarden (1988) designated a lectotype for *C. insidiosum* (leg. Galzin 8788, deposited at PC). Basidiospores of Iranian *C. insidiosum* specimens are $4.5 \times 2.2.5 \mu\text{m}$ (Hallenberg 1980). Basidiospores of specimen from temperate Taiwan are larger, $4.2.5.5 \times 2.8.3.3 \mu\text{m}$. The measurements based on North European *C. ochraceum* specimens ($4.5.6 \times 3.3.5 \mu\text{m}$, from Eriksson & Ryvarden 1975) are close to those from Taiwan. The name *C. ochraceum* is used for the Taiwan sample pending better understanding of its relationship with *C. insidiosum*.

Conferticium ravum (Burt) Ginns & Freeman, Biblioth. Mycol. 157:31. 1994. (Figs. 7, 25H-I & 26E)

≡ *Corticium ravum* Burt, Ann. Missouri Bot. Gard. 13:251. 1926.

≡ *Gloeocystidium karstenii* Bourd. & Galz., Hym. de France:254. 1928.

≡ *Conferticium karstenii* (Bourd. & Galz.) Hallenb., Mycotaxon 11:448. 1980.

Fruit body resupinate, effuse, adnate, membranaceous, 40-120 μm thick in section. Hymenial surface "brownish orange" (5C5) to "greyish orange" (5B4), smooth, cracked; margin rather determinate, paler.

Hyphal system monomitic; hyphae simple-septate, cyanophilous and dextrinoid. Subiculum fairly uniform, composed of basal layer, with compact

texture; hyphae hyaline or somewhat yellow, horizontal, usually glued together and indistinct, 2-3 μm diam, with thin or thickened walls. Subhymenium thickening, differentiated from subiculum, with compact texture; hyphae mainly vertical, somewhat yellow, glued together and indistinct, ca. 2 μm diam, with thickened walls. Gloeocystidia emergent or immersed, hyaline or yellowish, cylindrical or $\pm$ fusiform, quite often apically with a schizopapillate constriction, 30-100 $\times$ 5-10 μm , with thin or slightly thickened walls, SA+. Basidia clavate, 20-24 $\times$ 5-6 μm , with thickened walls at least for the basal parts, 4-sterigmate. Basidiospores ellipsoid, aculeate-verrucose (smooth in KOH), thin-walled, with a distinct apiculus, (5.8-) 6-7.2 (-8) $\times$ 3.6-4.3 μm (Wu 9210-107 SPR: $X = 6.61 \pm 0.51 \times 3.83 \pm 0.21 \mu\text{m}$, $n = 30$), IKI bluish black, CB-.

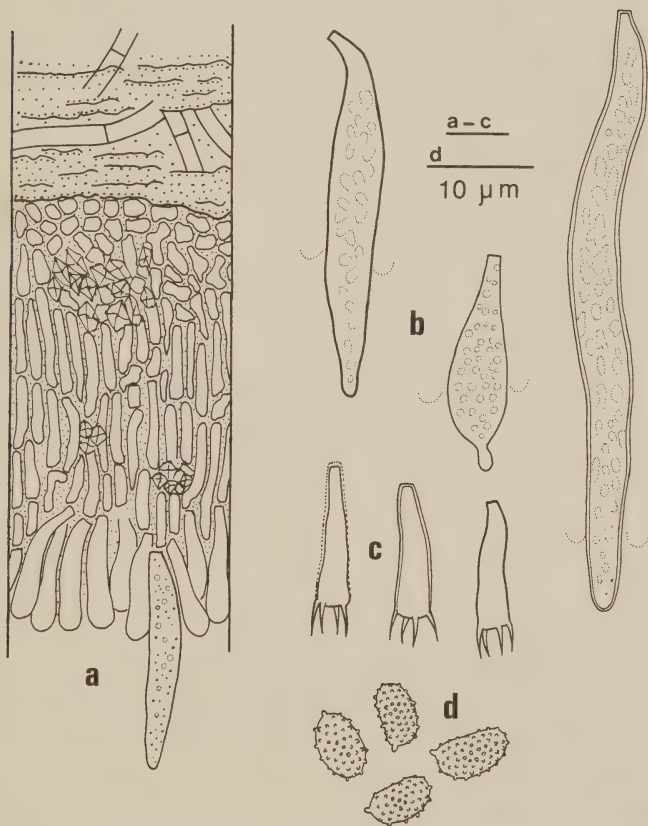


Fig. 7. *Conferticium ravum* (Wu 9210-107). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (in IKI).

Specimens examined: Taiwan. Nantou: Tungpu, alt. 1300 m, on branch of angiosperm, 8.X.1992, Wu 9210-97 (N.M.N.S.), Wu 9210-107 (N.M.N.S.).

Distribution: Pantemperate and subtropical.

Cultural description (PS-mycelium of Wu 9210-107):

1 wk growth: Colony radius 21-25 mm. Advancing zone even. Mats white. Aerial mycelium pellicular or almost absent. 2 wk growth: Colony radius 42-52 mm. Advancing zone fairly even. Mats white, slightly yellow around inoculum. Aerial mycelium pellicular or almost absent. 3 wk growth: Plates partly covered. Mats slightly yellow. Aerial mycelium slightly pellicular. 6 wk growth: Mats yellow, slightly fimbriate. Aerial mycelium almost absent, occasionally forming pale orange-yellow mass(es) lining the plate margin. Hyphal system monomitic. Aerial hyphae hyaline, sparsely ramified, mostly simple-septate, rarely with single or multiple clamped septa in wide hyphae, 1.5-6.5 μm diam, thin-walled, usually guttulate, occasionally curved as a loop. Gloeoplerous hyphae slightly yellow, 4-7 μm diam, thin- or slightly thick-walled, SA-. Submerged hyphae hyaline, sparsely ramified, simple-septate, 1.5-5 μm diam, thin-walled. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++, 20; 25. GAA: +++, tr; 10. TYA: -, 35; 55.

Species code:

2a, 5, 15b, 32, 36, 37, 38, 43-44, 54, (57), 66.

Sexuality: Presumed homothallic.

Cytology: Spores binucleate, MS-mycelium multinucleate, PS-mycelium multinucleate.

Nuclear behavior: Holocoenocytic.

Remarks: *Conferticium ravum* was well known as *C. karstenii* until Ginns (1992) found that *Corticiium ravum* Burt is conspecific with *C. karstenii*, and the former has priority. *Conferticium* contains both smooth- and ornamented-spored species. The finding of holocoenocytic nuclear behavior in this species confirms the placement of *C. ravum* and *C. ochraceum* together in the same genus.

Gloeocystidiellum Donk em. Donk, Fungus 26:8. 1956. -- Nederl. Mycol. Ver. Med. 18-20:156. 1931.

Fruit body resupinate, effuse, membranaceous or ceraceous. Hymenial surface smooth, rarely grandinoid or odontoid. Hyphal system monomitic; hyphae nodose- or simple-septate. Gloeocystidia present, usually SA+. Basidia clavate, 4-sterigmate. Basidiospores suballantoid, ellipsoid, subglobose or globose, verrucose or aculeate (smooth in KOH), thin-walled, IKI bluish black, CB-. Nuclear behavior normal or subnormal.

Remarks: *Gloeocystidiellum* s.s. in this paper is confined to species with acyanophilous hyphae, clavate basidia and ornamented basidiospores. Both clamped and clampless species are temporarily accommodated. Nuclear behavior normal or subnormal.

Key to known species of Taiwanese *Gloeocystidiellum*

1. Hyphae nodose-septate 3
1. Hyphae simple-septate 2
2. Encrusted cystidia present *G. laxum*
2. Encrusted cystidia lacking *G. aculeatum*
3. Subiculum uniformly loose. Gloeocystidia moniliform *G. moniliforme*
3. Subiculum not uniformly loose. Gloeocystidia not distinctly moniliform 4
4. Basidiospores $> 3.5 \mu\text{m}$ wide *G. aspellum*
4. Basidiospores $< 3.5 \mu\text{m}$ wide 5
5. Gloeocystidia become purple in SA. Basidiospores $< 4.3 \mu\text{m}$ long *G. purpureum*
5. Basidiospores $> 4.3 \mu\text{m}$ long 6
6. Basidiospores $> 3.3 \mu\text{m}$ wide *G. compactum*
6. Basidiospores $< 3.3 \mu\text{m}$ wide 7
7. Basidiospores $> 6.2 \mu\text{m}$ long *G. formosanum*
7. Basidiospores $< 6.2 \mu\text{m}$ long 8
8. Basidiospores $> 5 \mu\text{m}$ long *G. tabacinum*
8. Basidiospores mostly $< 5 \mu\text{m}$ long *G. porosum*

Gloeocystidiellum aculeatum S.H. Wu, sp. nov. (Figs. 8, 24I-J & 26F)

Basidiocarpum resupinatum, effusum, membranaceum, 100-300 μm crassum; superficies hymenialis odontoidea. Systema hypharum monomiticum; hyphae efibulatae. Gloeocystidia numerosa, globosa, clavata vel cylindrica, 7-20 μm diam, SA+. Basidia subclavata, 15-23 $\times$ 4-4.5 μm , 4 sterigmatibus. Basidiosporae subglobosae, aculeatae, tenuitunicatae, 3-3.5 $\times$ 2.3-2.8 μm , IKI lividae, CB-.

Holotypus: Taiwan. Kaohsiung: Liukuei, Shanping, alt. 750 m, on rotten wood of angiosperm, 14.VII.1989, Wu 890714-52 (N.M.N.S.; isotypus: LY).

Etymology: From aculeatus (= prickly), referring to the hymenial surface.

Fruit body resupinate, effuse, adnate, membranaceous (aculei subceraceous), 100-300 μm thick in section (aculei excluded). Hymenial surface "light orange" (5A4) to "pale yellow" (4A3), odontoid, cracked; margin paler, thinning, arachnoid. Aculei 3-5 per mm, mostly separate, conical or subulate, 120-250 μm wide, up to ca. 700 μm long.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of medullary layer, with fairly loose texture; hyphae hyaline, variously oriented, sparsely ramified, distinct, fairly straight, 2.5-5 μm diam, with 0.5-1.2 μm thick walls. Subhymenium thickening, with dense texture, differentiated from subiculum; hyphae hyaline, vertical, 2-3 μm diam, thin-walled. Trama with compact texture; hyphae hyaline, vertical. Gloeocystidia numerous, immersed or slightly emergent, hyaline to yellowish, globose, clavate or cylindrical, with stalked bases, with small oil-drops, 7-20 μm diam, up to ca. 150 μm long, with 0.6-1.3 μm thick walls, SA+. Basidia subclavate, 15-23 $\times$ 4-4.5 μm , 4-sterigmate. Basidiospores subglobose, aculeate (smooth in KOH), thin-walled, 3-3.5 $\times$ 2.3-2.8 μm , IKI bluish black, CB-.

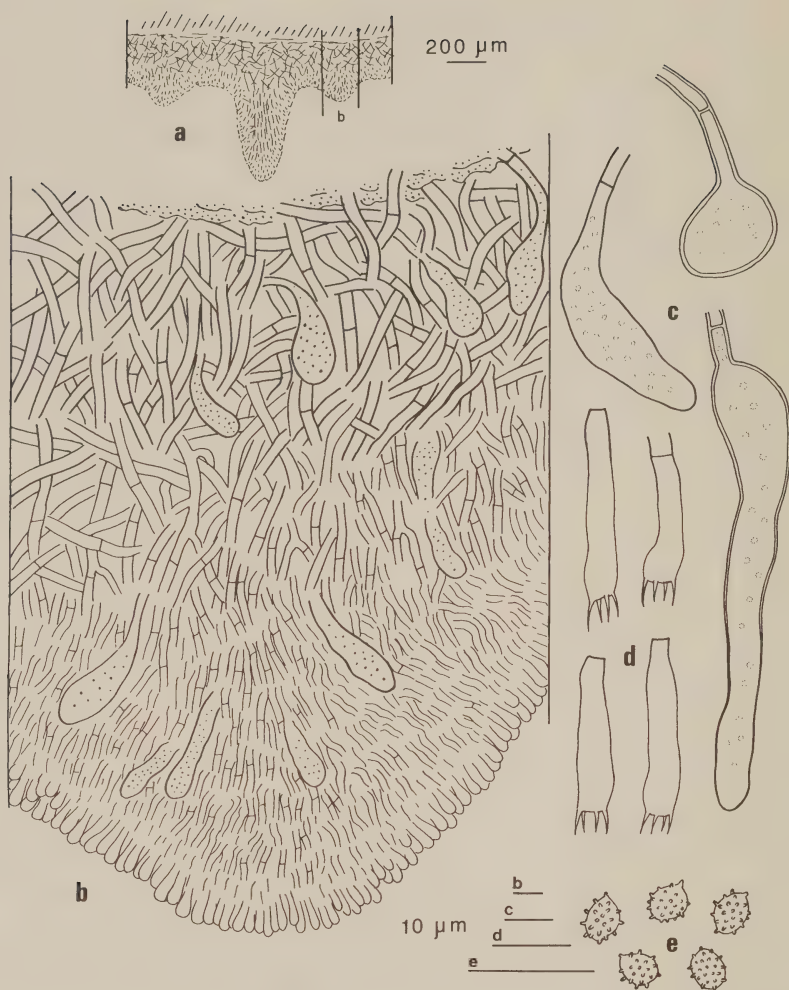


Fig. 8. *Gloeocystidiellum aculeatum* (holotype). a) Configuration of a fruit body section, b) fruit body section, c) gleocystidia, d) basidia, e) basidiospores (in IKI).

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Cultural description (FB-mycelium of holotype):

1 wk growth: Colony radius 2-3 mm. Advancing zone somewhat fimbriate. Mats white.

Aerial mycelium pellicular. 2 wk growth: Colony radius 3-5 mm. Advancing zone $\pm$ bayed. Mats white. Aerial mycelium pellicular. 3 wk growth: Colony radius 5-9 mm. 4 wk growth: Colony radius 7-15 mm. 5 wk growth: Colony radius 8-20 mm. 6 wk growth: Colony radius 15-30 mm. Advancing zone bayed, fimbriate. Mats white. Aerial mycelium pellicular. Hyphal system monomitic, simple-septate. Aerial hyphae hyaline, distinct and fairly straight, sparsely ramified, guttulate, 2.5-7.5 μ m diam, thin-walled; gloeoplerous hyphae numerous, containing yellowish oil-drops, up to ca. 12 μ m diam, thin-walled, SA-. Submerged hyphae similar to those of aerial hyphae but not so straight. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++, 0; 0. GAA: +++, 0; 0. TYA: +++, tr; 12.

Species code:

2, 6, 15b, 32, 36, 38, 47, 54, 64.

Cytology: FB-mycelium dikaryotic.

Remarks: Among *Gloeocystidiellum* s.l. species with an odontoid hymenial surface and simple-septate hyphae, this new species is similar to *Gloiothete lamellosa* (P. Henn.) Bres. but differs from the latter in having aculeate basidiospores. In addition, the projections on the hymenial surface of *G. lamellosa* are just hyphal pegs. This species is distinct from *Gloeocystidiellum convolvens* and *G. laxum* in lacking encrusted cystidia. *Gloeocystidiellum ontoideum* Khara differs from this new species by having clamped hyphae and bigger basidiospores.

Gloeocystidiellum aspellum Hjortst., Mycotaxon 28:27. 1987. (Figs. 9, 25K & 27A)

Fruit body resupinate, effuse, adnate, subceraceous or ceraceous, 50-500 μ m thick in section. Hymenial surface "greyish orange" (5B4) to "light orange" (5A4), smooth or slightly tuberculate, cracked when old; margin concolorous, thinning or rather determinate.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of basal layer, thin, sometimes indistinct, with compact texture; hyphae hyaline, mainly horizontal, usually glued together, 2-4 μ m diam, thin- or slightly thick-walled. Subhymenium distinctly thickening, differentiated from subiculum, with dense texture; hyphae hyaline, mainly vertical, 2-3 μ m diam, thin-walled. Gloeocystidia numerous, mostly immersed, tubular or cylindrical, slightly flexuous, usually gradually narrowing toward apices, with orange-yellow oily contents, 5-10 μ m diam, up to ca. 150 μ m long, basally thick-walled and apically thin-walled in long cystidia, the walls close to bases up to ca. 2 μ m thick, SA+. Basidia clavate, 25-35 $\times$ 6-7 μ m, 4-sterigmate. Basidiospores ellipsoid, verrucose (smooth in KOH), thin-walled, (6.5-) 7-8 (-8.2) $\times$ 3.5-4 μ m (Lin 625 SPR: $X = 7.50 \pm 0.43 \times 3.74 \pm 0.18 \mu$ m, $n = 30$), IKI bluish black, CB-.

Specimens examined: Kenya. Central Prov.: Mt. Elgon, Suam Forest Station, alt. ca. 2100 m, 23-24.I.1973. Ryv. 9146 (holotype, K); Ryv. 9147 (paratype, O). Taiwan. Ilan: Fushan Nature Reserve, alt. 600 m, on branch of angiosperm, 8.VIII.1991, Lin 625 (N.M.N.S., TAI).

Distribution: Kenya (type locality) and Taiwan.

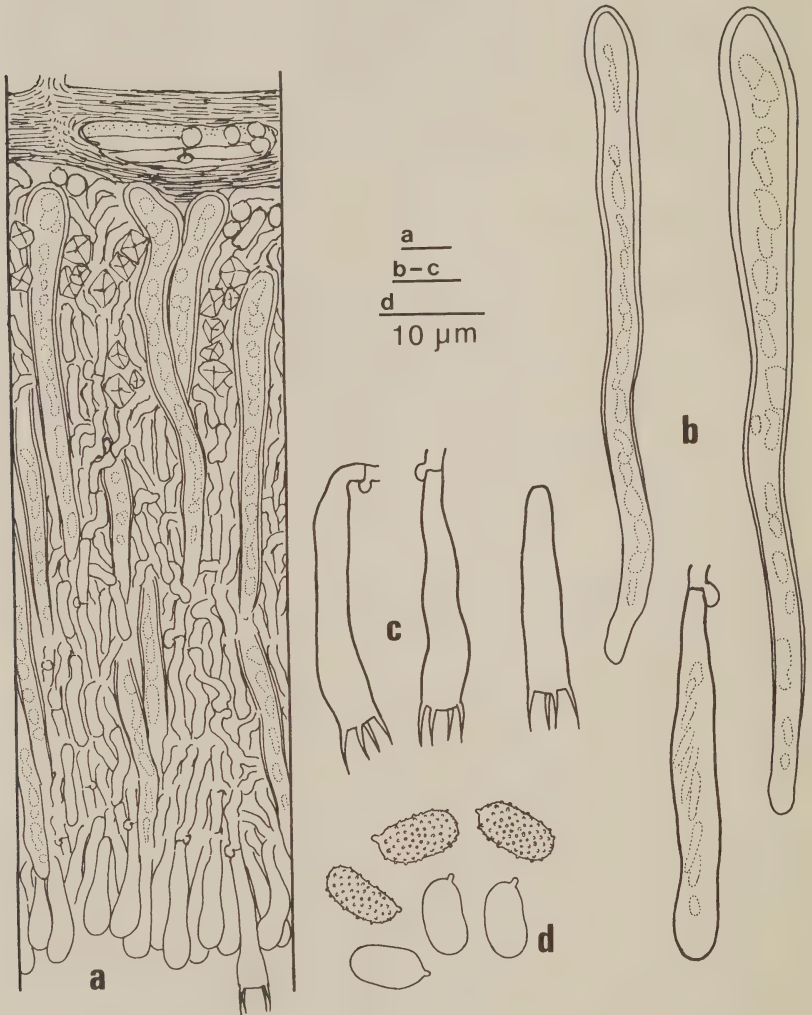


Fig. 9. *Gloeocystidiellum aspellum* (Lin 625). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (upper: in IKI; lower: in KOH).

Cultural description (SC-mycelium of Lin 625):

1 wk growth: Colony radius 3-7 mm. Advancing zone fairly even. Mats white. Aerial mycelium downy. 2 wk growth: 15-30 mm. 3 wk growth: 35-50 mm. 4 wk growth: 60-75 mm. Advancing zone fairly even. Mats white. Aerial mycelium downy. 5 wk growth: Plate covered. 6 wk growth: Mats whitish, slightly yellowish brown around inoculum. Aerial mycelium pellicular. Monomitic. Hyphae nodose-septate, hyaline, rarely yellow, sparsely or moderately ramified, guttulate, 1.5-3 μm diam, thin- or slightly thick-walled. Hyphal strands occasionally present, composed of yellow hyphae. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++, tr; 15. GAA: +++, tr; tr. TYA: -, tr; + or ++, 15.

Species code:

2, 3c, 16, 32, 36, 37, 38, 45, 54, 59, 61.

Sexuality: bipolar (A_1 : 1, 3, 4, 8, 9; A_2 : 2, 5, 6, 7).

Cytology: Spores uninucleate, MS-mycelium uninucleate, SC-mycelium dikaryotic.

Nuclear behavior: Normal.

Remarks: This species is close to *Gloeocystidiellum compactum*. Basidiospores are longer than those of *G. compactum*. These two species are incompatible (Lin 625 $\times$ Wu 880615-21, Lin 625 $\times$ Wu 890714-20).

***Gloeocystidiellum compactum* S.H. Wu, sp. nov. (Figs. 10, 24K & 27B)**

Basidiocarpum resupinatum, effusum, subceraceum vel ceraceum, 100-600 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae filulatae. Gloeocystidia numerosa, cylindrica vel tubularia, 5-10 μm diam, SA+. Basidia clavata, 17-27 $\times$ 5-6 μm , 4 sterigmatibus. Basidiosporae ellipsoideae vel late ellipsoideae, verrucosae vel aculeatae, tenuitunicatae, (5.2-) 5.8-6.5 (-6.8) $\times$ 3.3-4 μm , IKI lividae, CB-.

Holotypus: Taiwan. Kaohsiung: Liukuei, Shanping, alt. 750 m, on branch of angiosperm, 14.VII.1989, Wu 890714-20 (N.M.N.S.; isotypus: K).

Etymology: From compactus (= compact), referring to the fruit body texture of this species.

Fruit body resupinate, effuse, adnate, ceraceous or subceraceous, 100-600 μm thick in section, sometimes composed of two growth layers (new hymenial layer directly arising from old hymenial layer). Hymenial surface "light orange" (5A4), smooth or slightly tuberculate, cracked extensively; margin rather determinate, concolorous.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, thin, composed of basal layer with compact texture; hyphae mainly horizontal, hyaline, glued together and usually indistinct, 2-4 μm diam, thin- or slightly thick-walled. Subhymenium distinctly thickening, not clearly differentiated from subiculum, with compact texture; hyphae hyaline, vertical, glued together and indistinct. Crystal masses usually crowded or scattered in subiculum and

subhymenium. Gloeocystidia numerous, mostly immersed, cylindrical or tubular, somewhat wider basally, slightly flexuous, orange-yellow or subhyaline, 5-10 μm diam, up to ca. 100 μm long, SA+. Basidia clavate, 17-27 $\times$ 5-6 μm , 4-sterigmate. Basidiospores ellipsoid or broadly ellipsoid, adaxially flattened or slightly concave, with a distinct apiculus, verrucose-aculeate (smooth in KOH), thin-walled, (5.2-) 5.8-6.5 (-6.8) $\times$ 3.3-4 μm (Wu 910619-29 SPR: $X = 6.20 \pm 0.37 \times 3.67 \pm 0.25 \mu\text{m}$, $n = 30$), IKI bluish black, CB-.

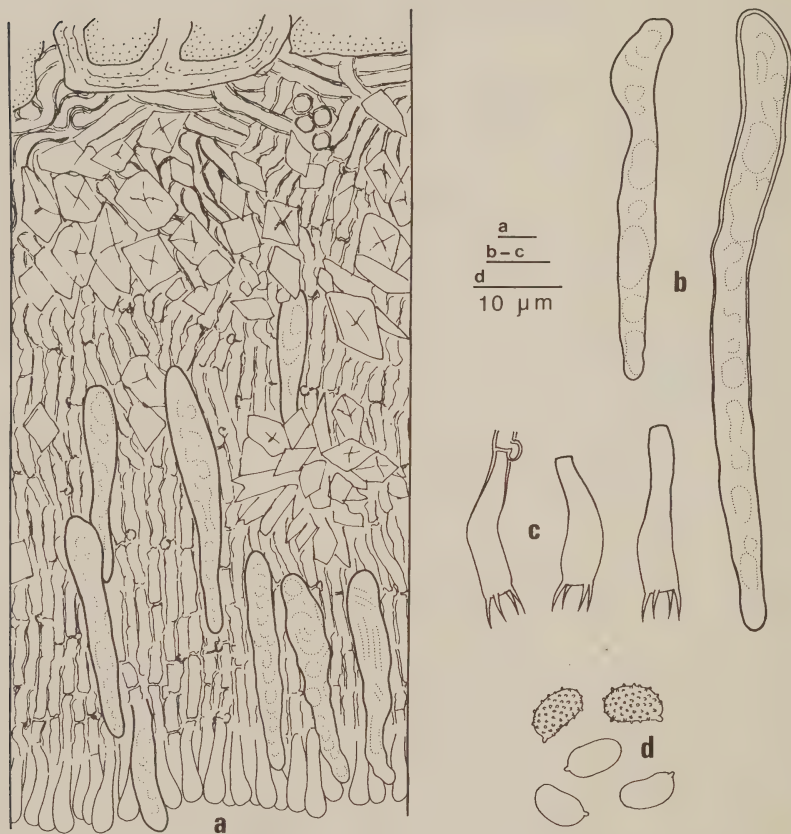


Fig 10. *Gloeocystidiellum compactum* (holotype). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (upper: in IKI; lower: in KOH).

Additional specimens examined: Taiwan. Pintung: Kenting National Park, Nanjenshan, alt. 200 m, on branch of angiosperm, 15.VI.1988, Wu 880615-21 (N.M.N.S.). Nantou: Sun-Moon Lake, alt. 750 m, on branch of *Helicia formosana*, 26.X.1988, Wu 881026-11 (N.M.N.S.); Lienhuachih, alt. 700 m, on decorticated branch of *Ormosia formosana*, 19.VI.1991, Wu 910619-6 (N.M.N.S.); on decorticated branch of angiosperm, 19.VI.1991, Wu 910619-29 (N.M.N.S.). Kaohsiung: Liukuei, Shanping, alt. 750 m, on branch of *Helicia formosana*, 22.XII.1993, Wu 9312-49 (N.M.N.S.).

Distribution: known only from Taiwan.

Cultural description (FB-mycelium of holotype):

1 wk growth: Colony radius 5-14 mm. Advancing zone even. Mats white. Aerial mycelium downy. 2 wk growth: Colony radius 22-34 mm. Advancing zone even. Mats white. Aerial mycelium downy-cottony. 3 wk growth: Colony radius 45-55 mm. Advancing zone even. Mats white. Aerial mycelium downy-cottony. 4 wk growth: Colony radius 61-78 mm. Advancing zone even. Mats white. Aerial mycelium downy-cottony. 5 wk growth: Plates partly covered. 6 wk growth: Mats white, yellow toward growth margins. Aerial mycelium downy-woolly. Hyphal system monomitic; hyphae nodose-septate. Aerial hyphae hyaline, rarely yellowish, fairly straight and distinct, sparsely or moderately ramified, 2-4 μm diam, thin- or slightly thick-walled. Gloeocystidia present in aerial mycelium, tubular, pale brown, 4-7 μm diam, thin-walled, SA purplish brown. Submerged hyphae hyaline, distinct, sparsely ramified, 1.5-4.5 μm diam, thin-walled. Cubical crystals present. Odor fruity. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++ or +++++, tr; 13. GAA: +++++, tr; 8. TYA: -, 15; 27.

Species code:

2a, 3c, 15a, 32, 36, 45-46, 50, 54, 62.

Cytology: Spores binucleate (Wu 9312-49), MS-mycelium uninucleate, FB-mycelium (Wu 880615-21) dikaryotic.

Nuclear behavior: Subnormal.

Remarks: *Gloeocystidiellum compactum* is similar to *G. formosanum* in the compact texture of the basidiome and subnormal nuclear behavior, but differs from the latter in having shorter and wider basidiospores. Incompatibility between them was demonstrated in this study, as indicated below under *G. formosanum*.

***Gloeocystidiellum formosanum* S.H. Wu, sp. nov. (Figs. 11, 24L & 27C)**

Basidiocarpum resupinatum, effusum, subceraceum vel ceraceum, 50-200 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Gloeocystidia numerosa, tubularia vel cylindrica, 6-12 μm diam, SA+. Basidia clavata, 16-22 $\times$ 5-6.5 μm , 4 sterigmatibus. Basidiosporae anguste ellipsoideae, aculeatae, tenuitunicatae, (6.2-) 6.5-7.5 (-7.7) $\times$ 2.8-3.2 μm , IKI lividae, CB-.

Holotypus: Taiwan. Taipei: Yangminshan, alt. 600 m, on branch of *Symplocos paniculata*, 13.XII.1990, Wu 901213-14 (holotypus: N.M.N.S.; isotypus: H).

Etymology: From Formosanus (referring to Formosa = Taiwan), in accordance with the place where type specimen was found.

Fruit body resupinate, effuse, adnate, subceraceous or ceraceous, 50-200 μm thick in section. Hymenial surface "light orange" (5A4), smooth, occasionally cracked; margin usually rather determinate, concolorous or deeper.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of basal layer, usually thin, with compact texture; hyphae hyaline, mainly horizontal, glued together and indistinct, 2-4 μm diam, thin- or slightly thick-walled. Subhymenium thickening, not clearly differentiated from subiculum, with compact texture; hyphae hyaline, mainly vertical, indistinct, usually glued together, slightly narrower than those of subiculum, thin- or slightly thick-walled. Gloeocystidia numerous, mostly immersed, tubular or cylindrical, somewhat flexuous, hyaline to yellow, 6-12 μm diam, up to ca. 100 μm long, with 0.5-1.5 μm thick walls, SA+. Basida clavate or subclavate, 16-22 $\times$ 5-6.5 μm , 4-sterigmate. Basidiospores narrowly ellipsoid, aculeate (smooth in KOH), thin-walled, (6.2-) 6.5-7.5 (-7.7) $\times$ 2.8-3.2 μm (holotype SPR: $X = 6.82 \pm 0.37 \times 2.99 \pm 0.12 \mu\text{m}$, $n = 30$), IKI bluish black, CB-.

Additional specimen examined: Nantou: Lienhuachih, alt. 700 m, on branch of angiosperm, 8.IV.1994, Wu 9404-16 (N.M.N.S.).

Distribution: Known only from Taiwan.

Cultural description (SC-mycelium of Wu 9404-16):

1 wk growth: Colony trace. Mats white. 2 wk growth: Colony radius 10 mm. Advancing zone $\pm$ fimbriate. Mats white. Aerial mycelium pellicular. 3 wk growth: Colony radius 17 mm. Advancing zone slightly bayed or slightly fimbriate. Mats white. Aerial mycelium pellicular. 4 wk growth: Colony radius 25 mm. Advancing zone slightly bayed or slightly fimbriate. Mats white. Aerial mycelium pellicular. 5 wk growth: Colony radius 32 mm. 6 wk growth: Colony radius 40 mm. Advancing zone slightly fimbriate. Mats white. Aerial mycelium slightly pellicular or almost absent. Hyphal system monomitic; hyphae nodose-septate. Aerial hyphae moderately or sparsely ramified, hyaline or rarely yellow, 1.5-4.5 μm diam, thin-walled; gloeoplerous hyphae hyaline, 4-6 μm diam, thin-walled, SA-, similar to normal hyphae. Submerged hyphae moderately ramified, hyaline, 2-4 μm diam, thin-walled. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: +++, tr; 8. GAA: ++ or +++, tr; tr. TYA: -, 0; tr.

Species code:

2a, 3c, 15b, 32, 36, 38, 47, 54, 59, 62.

Sexuality (Wu 9404-16): Bipolar (A_1 : 2, 3, 6, 8; A_2 : 4, 5, 9, 10).

Cytology (Wu 9404-16): Spores binucleate, MS-mycelium uninucleate, SC-mycelium dikaryotic.

Nuclear behavior: Subnormal.

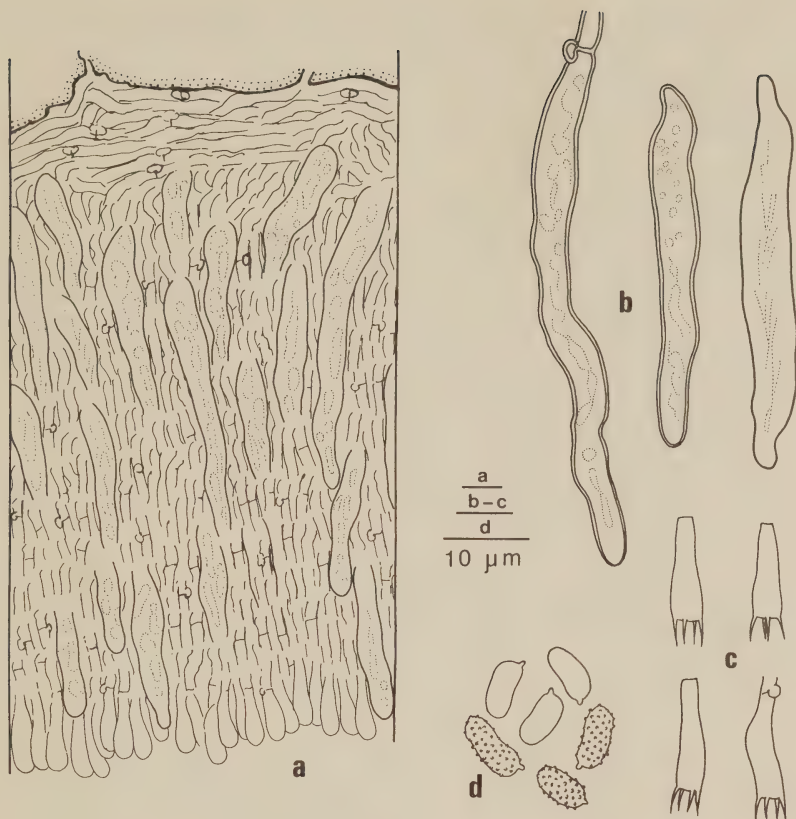


Fig. 11. *Gloecystidiellum formosanum* (holotype). a) Fruit body section, b) gloecystidia, c) basidia, d) basidiospores (upper: in KOH; lower: in IKI).

Remarks: This new species is similar to *Gloecystidiellum compactum* and *G. aspellum*, but with longer and narrower basidiospores than the former, and with smaller basidiospores than the latter. Incompatibilities between *G. formosanum* and *G. compactum* (Wu 901213-14 × Wu 890714-20, Wu 901213-14 × Wu 880615-21), as well as *G. formosanum* and *G. aspellum* (Wu 901213-14 × Lin 625), were respectively found in this study.

***Gloecystidiellum laxum* S.H. Wu, sp. nov. (Figs. 12, 25A-B & 27D)**

Basidiocarpum resupinatum, effusum, membranaceum, 150-300 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae efibulatae. Gloecystidia numerosa, tubularia vel cylindrica, 7-14 μm diam, SA+. Basidia clavata,

18-30 $\times$ 5-6.3 μm , 4 sterigmatibus. Basidiosporae late ellipsoideae vel subglobosae, verrucosae, tenuitunicatae, (4-) 4.2-4.6 (-4.8) $\times$ 3-3.5 (-3.7) μm , IKI lividae, CB-.

Holotypus: Taiwan. Nantou: Chitou, alt. 1250 m, on bark and decorticated trunk of dead *Cryptomeria japonica*, 10.X.1991. Wu 911010-8 (N.M.N.S.; isotypi: K, H).

Etymology: From *laxus* (= loose), referring to the texture of the fruit body.

Fruit body resupinate, effuse, somewhat loosely attached to the substratum, membranaceous, 150-300 μm thick in section. Hymenial surface "pale yellow" (4A3), smooth, occasionally cracked; margin usually paler, thinning, filamentose-pruinose, with marginal cordons.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of medullary layer, with loose texture; hyphae fairly straight, distinct, sparsely ramified, loosely interwoven, hyaline or subhyaline, sometimes brown-tinted near substratum, 3-6 μm diam, with 0.5-1.2 μm thick walls, occasionally with secondary septa. Subhymenium distinctly differentiated from subiculum, thickening, with compact texture; hyphae mainly vertical, hyaline, narrower than those of subiculum, thin- or slightly thick-walled. Gloeocystidia numerous, mostly of subiculum origin, rarely emergent, tubular or cylindrical, with stalked bases, flexuous, sometimes moniliform, subhyaline or slightly yellow, occasionally orange-yellow or brown-yellow, up to ca. 200 μm long, 7-14 μm diam, thin- or slightly thick-walled, usually with thicker walls at bases, occasionally with secondary septa near bases, SA+. Encrusted cystidia numerous, overlapping in hymenial layer, immersed or emergent, hyaline, subulate or conical, apically encrusted (encrusting crystals dissolve gradually but not completely in KOH), 25-45 $\times$ 6-12 μm (encrustation included), with thin to ca. 1 μm thick walls. Basidia subclavate, 18-30 $\times$ 5-6.3 μm , 4-sterigmate. Basidiospores broadly ellipsoid or subglobose, aculeate (smooth in KOH), thin-walled, with a distinct apiculus, (4-) 4.2-4.6 (-4.8) $\times$ 3-3.5 (-3.7) μm (holotype SPR: $X = 4.44 \pm 0.23 \times 3.22 \pm 0.17 \mu\text{m}$, $n = 30$), usually with a big oil-drop, IKI bluish black, CB-.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Cultural description (FB-mycelium of holotype):

1 wk growth: Colony radius 14 mm. Advancing zone fairly even. Mats white. Aerial mycelium almost absent. 2 wk growth: Colony radius 44 mm. Advancing zone fairly even. Mats white. Aerial mycelium almost absent. 3 wk growth: Plate covered. 6 wk growth: Mats whitish. Aerial mycelium pellicular, forming clay yellow grandinioid-odontoid granules toward growth margins. Hyphal system monomitic; hyphae simple-septate. Hyphae of aerial granular mycelium hyaline, yellowish or brownish yellow, fairly distinct, sparsely or moderately ramified, usually guttulate, 2-8 μm diam, thin-walled; gloeoplerous hyphae numerous, indistinctly differentiated from normal hyphae, SA+. Submerged hyphae hyaline, distinct, sparsely ramified, guttulate, 2-7 μm diam, thin-walled, SA-. No distinct odor. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (–), p-Cresol (–).

TAA: +, 0; 0. GAA: +++, 0; 0. TYA: ++, 25-35; 40-50.

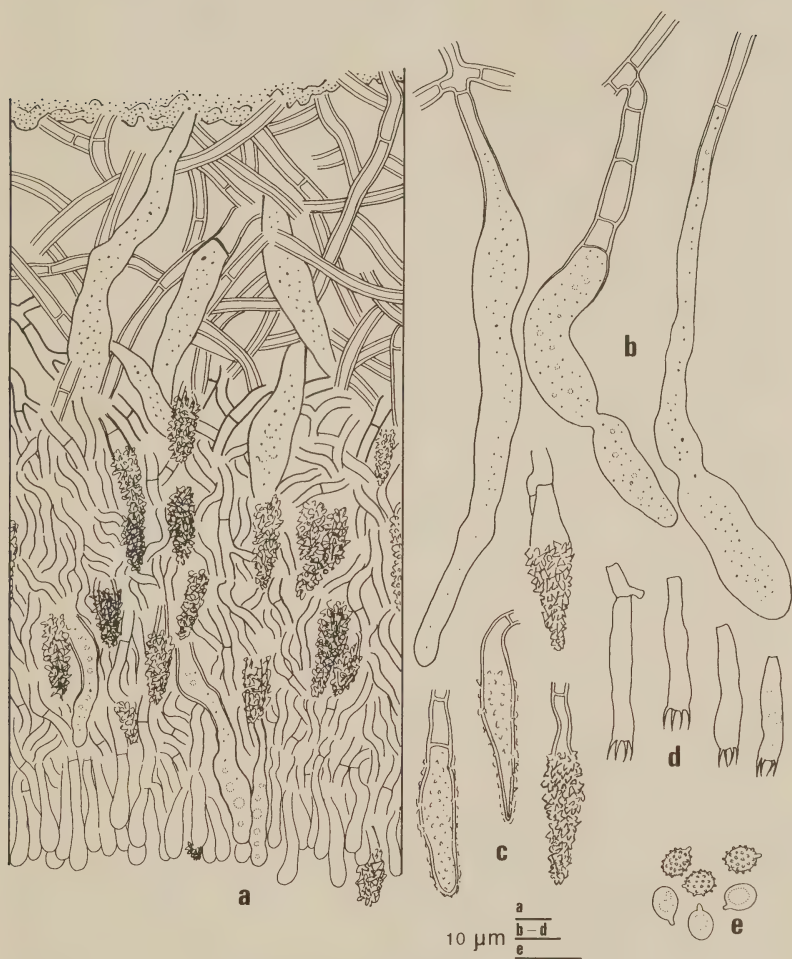


Fig. 12. *Gloeocystidiellum laxum* (holotype). a) Fruit body section, b) gloeocystidia, c) encrusted cystidia, d) basidia, e) basidiospores (upper: in IKI; lower: in KOH).

Species code:

2, 6, 15a, 32, 36, 38, 43, 50, 55, 64.

Cytology: FB-mycelium dikaryotic.

Remarks: *Gloeocystidiellum laxum* belongs to the *G. convolvens* group which is characterized by simple-septate hyphae and encrusted cystidia. This new species is very closely related to *G. convolvens*, although several characteristics combine to separate them. Macroscopically, the hymenial surface of *G. convolvens* is tuberculate with dense warts, while that of *G. laxum* is strictly smooth. Microscopically, the subiculum of *G. laxum* is distinctly looser in texture, and with wider subicular hyphae which are more thick-walled. *Gloeocystidiellum laxum* also resembles *G. fimbriatum* Burds., Nakas. & Freeman but the latter lacks lamprocystidia. In the protologue (Burdsall et al. 1981), basidiospores of *G. fimbriatum* were reported to be $5.5\text{--}6\text{--}(-6.5) \times 3.5\text{--}4\text{ }\mu\text{m}$; while those which I measured from the holotype (Burdsall 4620, CFMR) were $4\text{--}4.8 \times 3\text{--}3.5\text{ }\mu\text{m}$, similar in size to those of *G. laxum*.

***Gloeocystidiellum moniliforme* S.H. Wu, sp. nov. (Figs. 13 & 25C-D)**

Basidiocarpum resupinatum, effusum, membranaceum, 150–450 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Gloeocystidia numerosa, moniliformia, 6–14 μm diam, SA+. Basidia clavata, $25\text{--}35 \times 5\text{--}6\text{ }\mu\text{m}$, 4 sterigmatibus. Basidiosporae late ellipsoideae vel subglobosae, verrucoso-aculeatae, tenuitunicatae, $4.2\text{--}5 \times 3.3\text{--}4\text{ }\mu\text{m}$, IKI lividae, CB–.

Holotypus: Taiwan. Nantou: Lienhuachih, alt. 700 m, on branch of angiosperm, 25.X.1988, Wu 881025-30 (N.M.N.S.; isotypus: TAI).

Etymology: From moniliformis (= moniliform), referring to the shape of the gloeocystidia.

Fruit body resupinate, effuse, adnate, membranaceous or submembranaceous, 150–450 μm thick in section. Hymenial surface "pale yellow" (4A3) to "light yellow" (4A4), smooth, cracked; margin rather determinate, concolorous.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of medullary layer, with loose texture; hyphae generally hyaline, brownish yellow close to substratum, $\pm$ horizontal, distinct, fairly straight, 1.8–3.5 μm diam, with thin to ca. 1 μm thick walls, usually covered with a yellow scattered granular material. Subhymenium somewhat thickening, with dense texture; hyphae hyaline, $\pm$ vertical, thin-walled. Gloeocystidia numerous, usually immersed, moniliform toward apices, widest about middle, with stalked bases, with yellow oily contents, 6–14 μm diam, up to ca. 150 μm long, thin-walled, SA+. Basidia clavate, with stalked bases, $25\text{--}35 \times 5\text{--}6\text{ }\mu\text{m}$, 4-sterigmate. Basidiospores subglobose, verrucose-aculeate (smooth in KOH), thin- or slightly thick-walled, containing oily drops, $4.2\text{--}5 \times 3.3\text{--}4\text{ }\mu\text{m}$, IKI bluish black, CB–.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

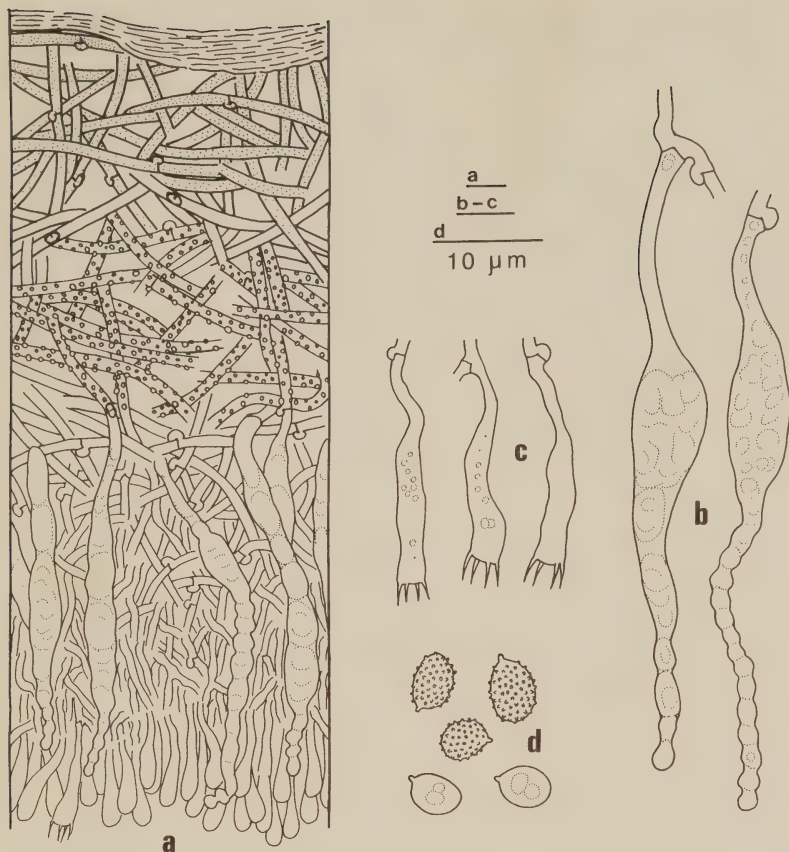


Fig. 13. *Gloeocystidiellum moniliforme* (holotype). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (upper: in IKI; lower: in KOH).

Remarks: This new species resembles *Gloeocystidiellum fimbriatum* in the loose texture of the body fruit and the similar size of the basidiospores, but differs from the latter in having moniliform gloeocystidia and slightly bigger basidiospores.

Gloeocystidiellum porosum (Berk. & Curt.) Donk, Nederl. Mycol. Ver. Med. 18-20:156. 1931. (Figs. 14 & 25E)

≡ *Corticium porosum* Berk. & Curt. in Berk. & Br., Ann. Mag. Nat. Hist. Ser. 5, 3:211. 1879.

≡ *Gloeocystidium porosum* (Berk. & Curt.) Wakefield in Bourd. & Galz., Hym. France :253. 1928.

Fruit body resupinate, effuse, adnate, membranaceous, 70-200 μm thick in section. Hymenial surface "pale yellow" (4A3) to "light yellow" (4A4), smooth or slightly tuberculate, extensively cracked; margin thinning, paler, arachnoid-pruinose.

Hyphal system monomitic; hyphae nodose-septate. Subiculum bi-layered, composed of basal layer and medullary layer. Basal layer with compact texture, up to ca. 20 μm thick, sometimes indistinct; hyphae hyaline, $\pm$ glued together, 2-3 μm diam, thin-walled. Medullary layer with fairly loose texture; hyphae hyaline, variously oriented, 2-3 μm diam, thin-walled. Subhymenium thickening, not clearly differentiated from medullary layer, with dense texture; hyphae $\pm$ vertical, much branched, hyaline, slightly narrower than those of subiculum, thin-walled. Gloeocystidia numerous, mostly immersed, cylindrical, sometimes slightly flexuous, hyaline or subhyaline, $40-90 \times 8-15 \mu\text{m}$, walls up to ca. 1.2 μm thick, SA+. Basidia narrowly clavate, $20-30 \times 4-5 \mu\text{m}$, 4-sterigmate. Basidiospores ellipsoid or broadly ellipsoid, verrucose (smooth in KOH), thin-walled, $(4-) 4.3-5 (-5.2) \times 2.8-3.2 \mu\text{m}$ (Wu 911206-12 SPR: $X = 4.63 \pm 0.30 \times 2.95 \pm 0.13$, $n = 30$), IKI bluish black, CB-.

Specimens examined: Taiwan. Nantou: Pilu, alt. 2000 m, on branch of angiosperm, 6.XII.1991, Wu 911206-1 (N.M.N.S.); on branch of *Alnus formosana*, 6.XII.1991, Wu 911206-12 (N.M.N.S.). Yushan National Park, Nanshilindao, alt. 1950 m, on branch of angiosperm, 13.X.1993, Wu 9310-51, 9310-52 (N.M.N.S.); 3.V.1994, Wu 9405-49 (N.M.N.S.); alt. 2200 m, on branch of angiosperm, 14.X.1993, Wu 9310-76, 9310-93, 9310-98, 9310-109 (N.M.N.S.); alt. 2250 m, Wu 9310-123 (N.M.N.S.); alt. 2100 m, on branch of angiosperm, 13.X.1994, Wu 9410-49 (N.M.N.S.).

Distribution: Pantemperate.

Cultural description (PS-mycelium of Wu 9405-49):

1 wk growth: Colony radius 9-12 mm. Advancing zone even. Mats whitish. Aerial mycelium almost absent. 2 wk growth: Colony radius 25-28 mm. Advancing zone even. Mats whitish. Aerial mycelium almost absent. 3 wk growth: Colony radius 42-45 mm. Advancing zone even. Mats whitish. Aerial mycelium almost absent. 4 wk growth: Colony radius 58-61 mm. 5 wk growth: Colony radius 73-77 mm. 6 wk growth: Plate covered. Mats whitish, slightly yellow around inoculum. Aerial mycelium almost absent. Hyphal system monomitic. Hyphae nodose-septate, hyaline, moderately ramified, 2-5 μm diam, thin-walled, usually guttulate. Cubical crystals present. Odor sweet. Not fruiting.

Oxidase reactions:

Syringaldazine (-), 1-Naphthol (-), L-tyrosine (-), p-Cresol (-).

TAA: -, 0; 0. GAA: ++, 0; +++, tr. TYA: -, 15; 30.

Species code:

2a, 3c, 7, 32, 36, 38, 46, 50, 54, 60, 61.

Sexuality (Wu 911206-12): Tetrapolar (A_1B_1 : 1, 9; A_1B_2 : 2, 3, 7, 10; A_2B_1 : 4; A_2B_2 : 6, 8).

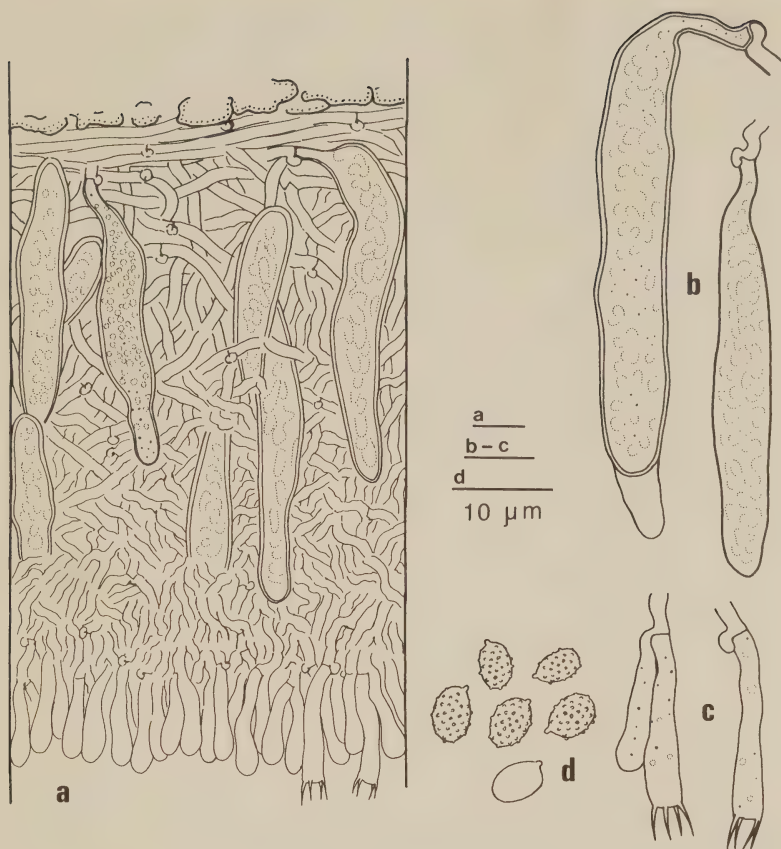


Fig. 14. *Gloeocystidiellum porosum* (Wu 911206-12). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores (upper: in IKI; lower: in KOH).

Cytology (Wu 911206-12): Spores uninucleate, MS-mycelium uninucleate, SC-mycelium dikaryotic.

Nuclear behavior: Normal.

Remarks: *Gloeocystidiellum porosum* was the mostly encountered species in this study having been collected several times in temperate Taiwan. This species is also widely distributed in temperate regions of the world. According to Nakasone (1982), the closely related species *G. clavuligerum* (Höhn. & Litsch.) Nakas., has broader basidiospores and shorter gloeocystidia which are apically constricted.

***Gloeocystidiellum purpureum* S.H. Wu, sp. nov. (Figs. 15, 25F & 27E)**

Basidiocarpum resupinatum, effusum, membranaceum, 80-200 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Gloeocystidia numerosa, cylindrica, 5-10 μm diam, SA+. Basidia clavata, 15-25 $\times$ 3.5-4 μm , 4 sterigmatibus. Basidiosporae subglobose, verrucosae, tenuitunicatae, 3.8-4.3 $\times$ 2.9-3.4 μm , IKI lividae, CB-.

Holotypus: Taiwan. Nantou: Yushan National Park, Nanshilindao, alt. 1950 m, 13.X.1993, Wu 9310-45 (N.M.N.S.; isotypus: BPI).

Etimology: From purpureus (= purple), referring to the color of the gloeocystidia in SA.

Fruit body resupinate, effuse, adnate, membranaceous, 80-200 μm thick in section. Hymenial surface "pale yellow" (4A3) to "yellowish white" (4A2), smooth, occasionally cracked; margin thinning, paler, arachnoid-pruinose.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of a thin basal layer, with dense texture; hyphae horizontal, hyaline, 2-3.5 μm diam, thin-walled, with numerous small oil-drops. Subhymenium thickening, differentiated from subiculum; hyphae $\pm$ vertical, hyaline, 1.5-3 μm diam, thin-walled, with numerous small oil-drops. Gloeocystidia numerous, usually immersed, cylindrical, $\pm$ flexuous, usually schizopapillate toward apices, hyaline, 5-10 μm diam, up to 120 μm long, thin- or slightly thick-walled, SA+ (turning purple) when fresh, but SA- 5 months after collection. Basidia clavate, 15-25 $\times$ 3.5-4 μm , 4-sterigmate. Basidiospores subglobose, verrucose (smooth in KOH), thin-walled, 3.8-4.3 $\times$ 2.9-3.4 μm (holotype SPR: $3.99 \pm 0.17 \times 3.13 \pm 0.16 \mu\text{m}$, $n = 30$), IKI bluish black, CB-.

Specimen examined: Taiwan (see type).

Cultural description (SC-mycelium of holotype):

1 wk growth: Colony radius 12-18 mm. Advancing zone fimbriate, with very sparse mycelia toward growth margins. Mats white. Aerial mycelium downy or cottony. 2 wk growth: Colony radius 40-48 mm. Advancing zone slightly fimbriate, with very sparse mycelia toward margins. Mats whitish. Aerial mycelium downy-plumose. 3 wk growth: Colony radius 65-73 mm. 4 wk growth: Plate covered. 6 wk growth: Mats whitish. Aerial mycelium pellicular or almost absent, slightly plumose. Hyphal system monomitic. Hyphae nodose-septate, hyaline, moderately ramified, 1.5-3 μm diam, thin-walled. Cubical crystals abundant. Odor fruity. Not fruiting.

Oxidase reactions:

Syringaldazine (+), 1-Naphthol (+), L-tyrosine (-), p-Cresol (-).

TAA: -, 0; 0. GAA: +, 0; 0. TYA: +++, tr; 20.

Species code:

2, 3c, 7, 32, 36, 38, 44, 49, 50, 54, 60, 61.

Sexuality: Tetrapolar (A_1B_1 : 1, 11; A_1B_2 : 3; A_2B_1 : 5, 9, 10, 12; A_2B_2 : 4).

Cytology: Spores uninucleate, MS-mycelium uninucleate, SC-mycelium dikaryotic.

Nuclear behavior: Normal.

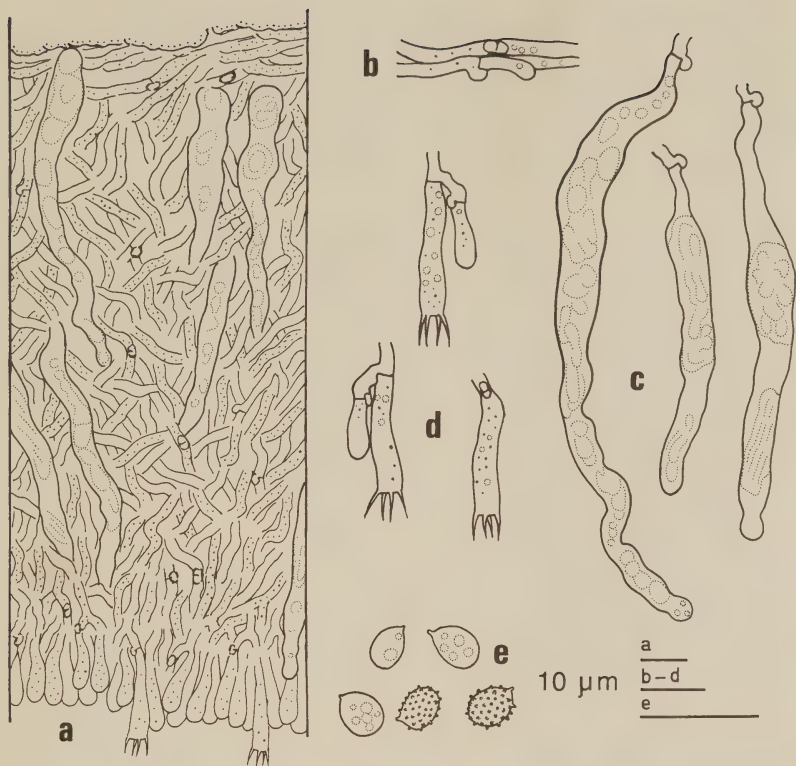


Fig. 15. *Gloeocystidiellum purpureum* (holotype). a) Fruit body section, b) basal hyphae, c) gloeocystidia, d) basidia, e) basidiospores (upper & left: in KOH; lower: in IKI).

Remarks: This new species is similar to *Gloeocystidiellum kenyense* Hjortst. but the latter has smaller basidiospores ($3\text{--}3.8 \times 2.3\text{--}2.8 \mu\text{m}$, measured from holotype: Ryv. 8996 at O). Moreover, from both the description in the protologue (Hjortstam 1987b) and my observation of the holotype, gloeocystidia of *G. kenyense* have a negative reaction in SA. It is not known whether the negative reaction is a result of long storage in the herbarium. Gloeocystidia of *G. purpureum* turn purple in SA, a peculiar color change for species in the genus.

***Gloeocystidiellum tabacinum* S.H. Wu, sp. nov. (Figs. 16 & 25G)**

Basidiocarpum resupinatum, effusum, ceraceum, 80–300 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Gloeocystidia

numerosa, cylindrica vel tubularia, 6-12 μm diam, SA+. Basidia subclavata, 18-28 $\times$ 4-5 μm , 4 sterigmatibus. Basidiospores ellipsoideae, verrucosae, tenuitunicatae, 5-6.2 $\times$ 2.9-3.3 μm , IKI lividae, CB-.

Holotypus: Taiwan. Ilan: Fushan Nature Reserve, alt. 600 m, on branch of angiosperm, 3.IX.1992, Wu 9209-19 (N.M.N.S.; isotypus: BPI).

Etymology: From tabacinus (= pale brown), referring to the color of the fruit body.

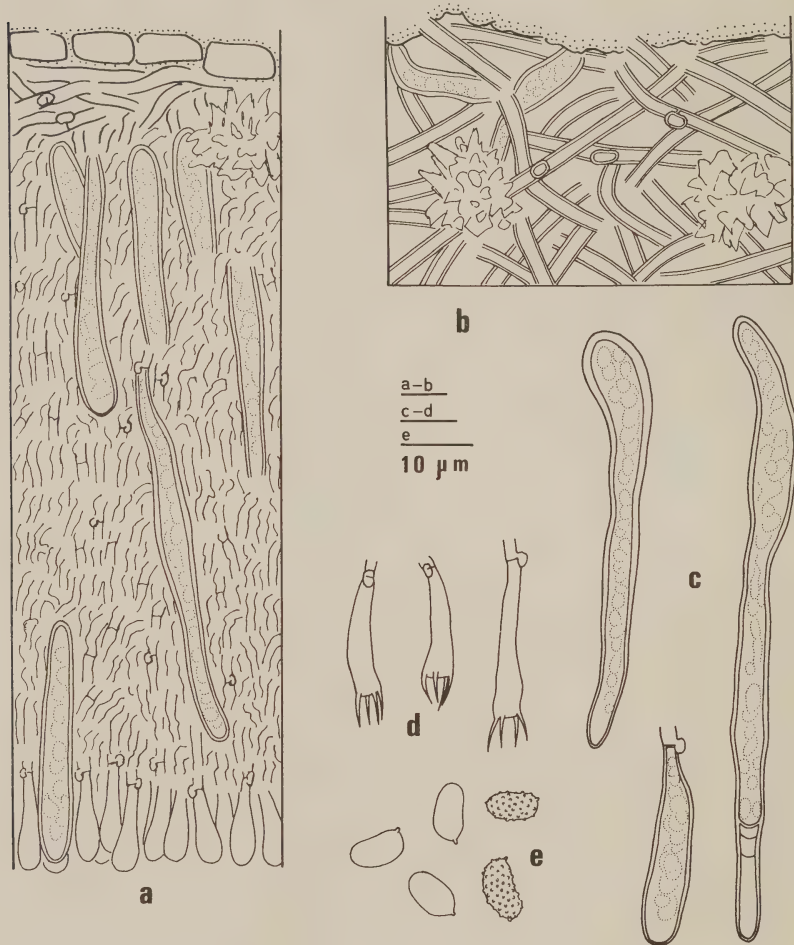


Fig. 16. *Gloeocystidiellum tabacinum* (holotype). a) Fruit body section, b) section showing a loose subiculum, c) gloeocystidia, d) basidia, e) basidiospores (left: in KOH; right: in IKI).

Fruit body resupinate, effuse, adnate, ceraceous or subceraceous, 80-300 μm thick in section, sometimes composed of two growth layers. Hymenial surface "light brown" (5D4), smooth, occasionally cracked; margin thinning or rather determinate, concolorous.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of a thin basal layer with fairly dense texture, or composed of a medullary layer with fairly loose texture; hyphae hyaline, 2.5-5 μm diam, with walls to ca. 1 μm thick. Crystal masses scattered or crowded in subiculum. Subhymenium distinctly thickening, differentiated from subiculum, with compact texture; hyphae mainly vertical, hyaline, 1.5-3 μm diam, thin-walled. Gloecystidia numerous, mostly immersed, cylindrical or tubular, slightly flexuous, with yellow or orange yellow oily contents, 6-12 μm diam, up to ca. 120 μm long, with 1-2 μm thick walls, SA+. Basidia subclavate, $18-28 \times 4-5 \mu\text{m}$, 4-sterigmate. Basidiospores ellipsoid, adaxially slightly concave, verrucose (smooth in KOH), thin-walled, $5-6.2 \times 2.9-3.3 \mu\text{m}$, IKI bluish black, CB-.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Remarks: This new species is microscopically similar to *Gloeocystidiellum compactum* and *G. formosanum*, but differs from the former in having narrower basidiospores, and contrasts with the latter in having shorter basidiospores. In addition, the subiculum of the above two species consists of a thin basal layer, while that of *G. tabacinum* is sometimes composed of a medullary layer of fairly loose texture.

Gloeomyces S.H. Wu, gen. nov.

Basidiocarpum resupinatum, effusum, membranaceum; superficies hymenialis plana. Systema hypharum dimiticum. Hyphae generatoriae efibulatae. Hyphae ligantes paucae. Gloecystidia numerosa, moniliformia, exigue SA+. Basidia utriformia, 4 sterigmatibus. Basidiosporae ellipsoideae, laeves, tenuitunicatae, IKI exigue lividae, CB-.

Typus: *Gloeomyces graminicola* S.H. Wu.

Etymology: From gloeo- (= glue) + -myces (= fungus), referring to the presence of gloecystidia.

Fruit body resupinate, effuse, membranaceous. Hyphal system dimitic, composed of generative hyphae and binding hyphae. Generative hyphae simple-septate. Binding hyphae sparsely distributed in deep subiculum, yellow or brown. Gloecystidia numerous, moniliform, slightly SA+. Basidia utriform, 4-sterigmate. Basidiospores ellipsoid, smooth, thin-walled, IKI slightly bluish black, CB-.

Remarks: This new genus is distinct from other genera derived from *Gloeocystidiellum* s.l. by the presence of binding hyphae. Additionally, the known species in *Gloeomyces* uniformly have simple-septate generative hyphae, utriform basidia and smooth

basidiospores. Collections of *Gloeomyces* sp. were made from culms of Poaceae, indicating their preference of this kind of substrate. Some features of this genus are similar to those of *Gloiothele*, but in cultures *Gloeomyces graminicola* differ in that they produce hyphae with single or multiple clamps. FB-mycelia of *G. graminicola* are mostly dikaryotic, rarely with 3 nuclei in a cell. The hyphal septation and nuclear state of *G. graminicola* resemble the holocoenocytic nuclear behavior, but with lesser number of nuclei.

Key to species of *Gloeomyces*

1. Basidiospores longer than 9 μm *G. ginnsii*
1. Basidiospores shorter than 7 μm *G. graminicola*

Gloeomyces ginnsii S.H. Wu, sp. nov. (Fig. 17)

Basidiocarpum resupinatum, effusum, membranaceum, 100-200 μm crassum; superficies hymenialis plana. Systema hypharum dimiticum. Hyphae generatoriae efibulatae. Hyphae ligantes paucae. Gloeocystidia numerosa, moniliformia, 5-10 μm diam, exigue SA+. Basidia utriformia, $28-42 \times 6-8.5$ μm , 4 sterigmatibus. Basidiosporae ellipsoideae, laeves, tenuitunicatae, $9.5-12.5 \times 4.5-5.5$ μm , IKI exigue lividae, CB-.

Holotypus: Taiwan. Nantou: Yushan National Park, between Kuankao and Tueikuan, alt. 2400 m, on culm of *Yushania niitakayamensis*, Wu 880726-37 (N.M.N.S.).

Etymology: Named in honor of the prominent mycologist, Dr. James H. Ginns.

Fruit body resupinate, effuse, $\pm$ separable, membranaceous, 100-200 μm thick in section. Hymenial surface "light orange" (5A4) to "light yellow" (4A5), smooth, occasionally cracked; margin thinning, paler, filamentose-pruinose.

Hyphal system dimitic; generative hyphae simple-septate. Subiculum fairly uniform, composed of medullary layer, with fairly loose texture; hyphae variously oriented, sparsely ramified, distinct, fairly straight, hyaline or rarely yellow, 2.5-5 μm diam, thin- or slightly thick-walled. Subhymenium somewhat thickening, with dense texture; hyphae hyaline, narrower than those of subiculum. Binding hyphae few, sparsely scattered in deep subiculum, sometimes difficult to find, yellow or yellowish brown. Gloeocystidia numerous, mostly arising from subiculum, immersed or emergent, hyaline or yellow, moniliform, 5-10 μm diam, up to ca. 100 μm long, thin- or slightly thick-walled, slightly SA+. Basidia utriform, $28-42 \times 6-8.5$ μm , 4-sterigmate. Basidiospores ellipsoid, adaxially concave, with a distinct apiculus, smooth, thin-walled, $9.5-12.5 \times 4.5-5.5$ μm , IKI slightly bluish black, CB-.

Additional specimen examined: Taiwan. Nantou: Yushan National Park, between Kuankao and Tueikuan, alt. 2400 m, on culm of Poaceae, Wu 880726-9 (N.M.N.S.).

Distribution: Known only from Taiwan.

Remarks: All microscopical characters of the fruit body of this species are similar to those of *Gloeomyces graminicola*, except that basidiospores of *G. ginnsii* are much larger.

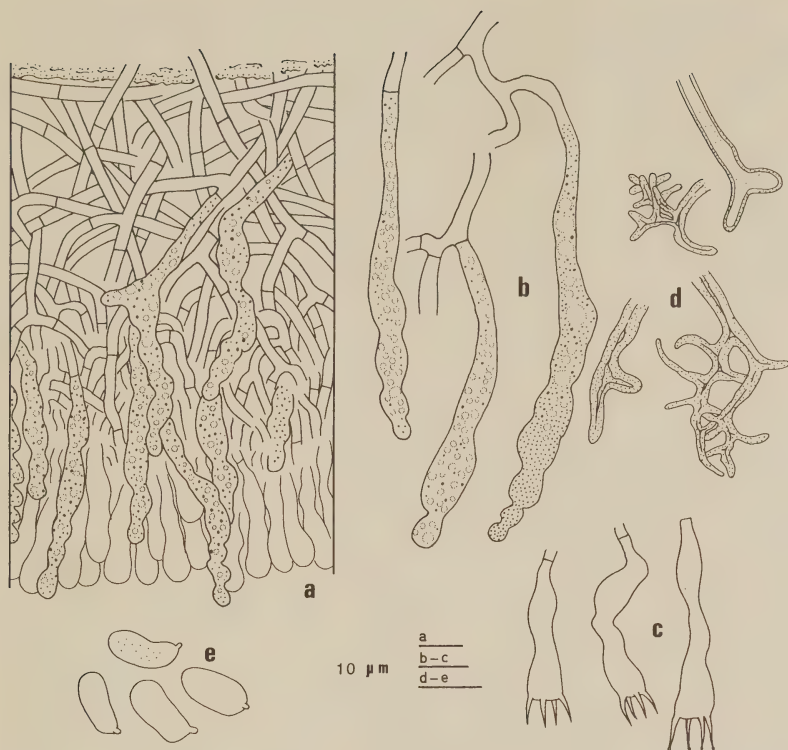


Fig. 17. *Gloeomyces ginnsii* (holotype). a) Fruit body section, b) gloeocystidia, c) basidia, d) binding hyphae, e) basidiospores.

***Gloeomyces graminicola* S.H. Wu, sp. nov. (Figs. 18 & 27F)**

Basidiocarpum resupinatum, effusum, membranaceum, 100-200 μm crassum; superficies hymenialis plana. Systema hypharum dimiticum. Hyphae generatoriae efibulatae. Hyphae ligantes fere sparsae. Gloeocystidia numerosa, moniliformia, 4-8 μm diam, exigue SA+. Basidia utriformia, 20-35 $\times$ 5-6 μm , 4 sterigmatibus. Basidiosporae ellipsoideae vel late ellipsoideae, laeves, tenuitunicatae, 5-6.5 $\times$ 3.3-4 μm , IKI exigue lividae, CB-.

Holotypus: Taiwan. Nantou: Yushan National Park, Nanshilindao, alt. 1600 m, on culm of Poaceae, 6.X.1992, Wu 9210-12 (N.M.N.S.).

Etymology: From graminicola (= growing on grass), referring to the substrate of the holotype.

Fruit body resupinate, effuse, adnate, membranaceous, 100-200 μm thick in section. Hymenial surface "pale orange" (5A3) to "orange white" (5A2), smooth, not cracked; margin thinning or rather determinate, concolorous, arachnoid.

Hyphal system dimitic; generative hyphae simple-septate. Subiculum fairly uniform, composed of medullary layer with fairly loose texture; generative hyphae $\pm$ horizontal near substratum, variously oriented elsewhere, hyaline, moderately ramified and loosely interwoven, 2-4 μm diam, thin- or slightly thick-walled; binding hyphae sparsely distributed, more abundant near substratum, brownish, with ca. 0.5 μm thick walls, sometimes almost solid. Subhymenium differentiated from subiculum, thickening, with compact texture; hyphae mainly vertical. Gloeocystidia numerous, mostly arising from subiculum, hyaline or

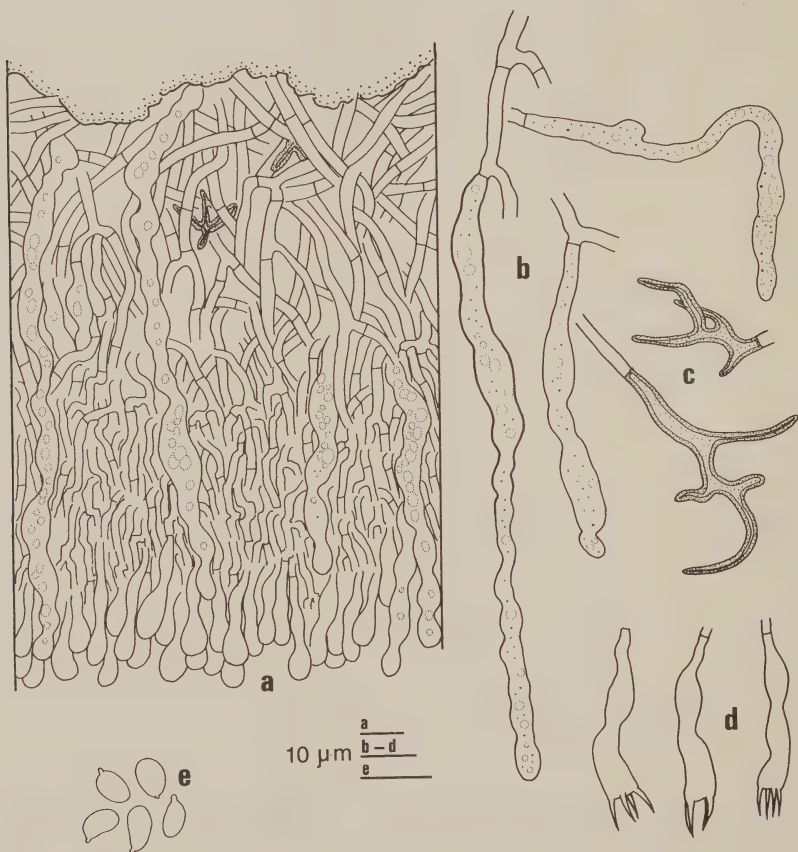


Fig. 18. *Gloeomyces graminicola* (holotype). a) Fruit body section, b) gloeocystidia, c) binding hyphae, d) basidia, e) basidiospores.

slightly yellow, tubular and moniliform, up to ca. 120 μm long, 4-8 μm diam, thin- or slightly thick-walled, slightly SA+. Basidia utriform, usually with a stalked base, 20-35 $\times$ 5-6 μm , 4-sterigmate. Basidiospores ellipsoid or broadly ellipsoid, smooth, thin-walled, bearing a distinct apiculus, with homogeneous contents, 5-6.5 $\times$ 3.3-4 μm , IKI slightly bluish black, CB-.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Cultural description (FB-mycelium of holotype):

1 wk growth: Colony radius 15-20 mm. Advancing zone even. Mats white. Aerial mycelium downy-pellicular. 2 wk growth: Colony radius 40-47 mm. Advancing zone even. Mats white. Aerial mycelium pellicular-downy. 3 wk growth: Colony radius 62-72 mm. 4 wk growth: Plate covered. 6 wk growth: Mats white. Aerial mycelium pellicular, slightly zonate. Hyphal system monomitic; hyphae mostly simple-septate, septa occasionally single or multiply clamped in wide hyphae. Aerial hyphae occasionally curved as a loop, hyaline, sparsely ramified, usually as guttulate gloeoplerous hyphae, 2-7 μm diam, thin- to slightly thick-walled, SA-. Submerged hyphae hyaline, guttulate or with fairly homogeneous contents, 2-5 μm diam, thin- to slightly thick-walled. Needle-like crystals present. Odor fruity. Not fruiting.

Oxidase reactions:

Syngaldazine (-), 1-Naphthol (-), L-tyrosine (-), p-Cresol (-).

TAA: -, 0; 0. GAA: -, 12; 20. TYA: -, 30; 65.

Species code:

1, 5, 15b, 32, 36, 38, 44, 49, 50, 54, *64.

Cytology: FB-mycelium mostly dikaryotic, rarely with 3 nuclei.

Remarks: In *G. graminicola*, the single to multiple clamped hyphae of FB-mycelia are mostly dikaryotic and rarely with 3 nuclei, resembling the holocoenocytic nuclear behavior but with lesser number of nuclei.

Gloiothele Bres., Ann. Mycol. Berl. 18:44. 1920.

Fruit body resupinate, effuse, membranaceous to ceraceous. Hyphal system monomitic; hyphae simple-septate. Subiculum usually fairly thin. Subhymenium usually thickening. Gloeocystidia numerous, SA+ or SA-. Basidia irregularly clavate or narrowly clavate, in some species somewhat utriform, 4-sterigmate. Basidiospores ellipsoid to globose, smooth, bearing a distinct apiculus, IKI slightly bluish black, CB-. Nuclear behavior subnormal.

Remarks: *Gloiothele* is characterized in having clampless hyphae and smooth basidiospores. Basidiospores are globose, subglobose or broadly ellipsoid, very thin-walled and weakly amyloid. The basidia are generally clavate, but in many species they can be irregularly swollen, and sometimes somewhat utriform. All species for which nuclear behavior is known are subnormal. Morphological features and nuclear behavior indicate that *Gloiothele* is a homogeneous genus. *Gloeocystidiellum zawitense* exhibits

all features of *Gloiothele*, and according to the protologue (Rattan et al. 1978) its basidiospores were measured as $8-10$ (-12) $\times$ $5.5-6$ (-8) μm . The dimension of basidiospores and other features of *Gloeocystidiellum zawitense* well fit those of *Gloiothele tropicalis*. The placement of *Gloeocystidiellum zawitense* in *Gloiothele* is proposed:

Gloiothele zawitense (Rattan, Abdullah & Ismail) S.H. Wu, comb. nov.

Basionym: *Gloeocystidiellum zawitense* Rattan, Abdullah & Ismail, Nova Hedwigia 29:768. 1978.

Key to species of *Gloiothele*

1. Hyphal pegs present *G. lamellosa*
1. Hyphal pegs absent 2
2. Basidiospores $> 5 \mu\text{m}$ long 4
2. Basidiospores $< 5 \mu\text{m}$ long 3
3. Hymenial surface becoming granulose. Gloeocystidia SA+. Basidia $< 30 \mu\text{m}$ long *G. granulosa* Hjortst. & Spooner
3. Hymenial surface smooth. Gloeocystidia SA-. Basidia $> 30 \mu\text{m}$ long *G. citrina*
4. Basidiospores $> 8 \mu\text{m}$ wide *G. zawitense* (?= *G. tropicalis*)
4. Basidiospores $< 8 \mu\text{m}$ wide 5
5. Basidiospores mostly $> 5.2 \mu\text{m}$ wide 7
5. Basidiospores mostly $< 5.2 \mu\text{m}$ wide 6
6. Hyphidia present. Basidia $< 40 \mu\text{m}$ long *G. lactescens*
6. Hyphidia lacking. Basidia $> 40 \mu\text{m}$ long *G. turpis* (Freeman) Hjortst.
7. Basidiospores mostly $> 6.3 \mu\text{m}$ long *G. citrinoidea*
7. Basidiospores mostly $< 6.3 \mu\text{m}$ long *G. globosa*

The species of *Gloiothele* recorded from Taiwan are *G. citrinoidea*, *G. globosa*, *G. lactescens* and possibly also *Gloeocystidiellum orientale* (this was mentioned in introduction).

Gloiothele citrinoidea S.H. Wu, sp. nov. (Fig. 19)

Basidiocarpum resupinatum, effusum, submembranaceum vel subceraceum, 50-120 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum. Hyphae efibulatae. Gloeocystidia numerosa, cylindrica vel fusiformia, $20-50 \times 4.5-8.5 \mu\text{m}$, SA+. Basidia clavata, $23-35 \times 6-7.5 \mu\text{m}$, 4 sterigmatibus. Basidiosporae fere globosae, laeves, tenuitunicatae, (6-) $6.3-7$ (-7.5) $\times$ (5-) $5.3-6$ (-6.2) μm , IKI exigue lividae, CB-.

Holotypus: Taiwan. Taipei: Taipei Botanical Garden, on sheath culm of *Phoenix dactylifera*, 27.VI.1992, Wu 9206-78 (N.M.N.S.; isotypus: LY).

Etymology: From citrinoidea (= citrina-like), referring to the resemblance of this new species to *Gloiothele citrina*.

Fruit body resupinate, effuse, adnate, submembranaceous to subceraceous, 50-120 μm thick in section. Hymenial surface "greyish yellow" (4B5) to "light

yellow" (4A4), smooth, occasionally cracked; margin usually paler, thinning, pruinose.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, with fairly dense texture, composed of medullary layer; hyphae hyaline, sometimes indistinct, moderately ramified, 1.5-3 μm diam, thin-walled. Subhymenium not clearly differentiated from subiculum, somewhat thickening. Gloecystidia numerous, irregularly cylindrical or fusiform, distributed in hymenial layer, fairly undifferentiated from basidioles in shape, 20-50 $\times$ 4.5-8.5 μm , thin-walled, SA+. Basidia clavate or narrowly clavate, $\pm$ flexuous, 23-35 $\times$ 6-7.5 μm , 4-sterigmate. Basidiospores almost globose, smooth, bearing a distinct apiculus, (6-) 6.3-7 (-7.5) $\times$ (5-) 5.3-6 (-6.2) μm , guttulate, IKI slightly bluish black, CB-.

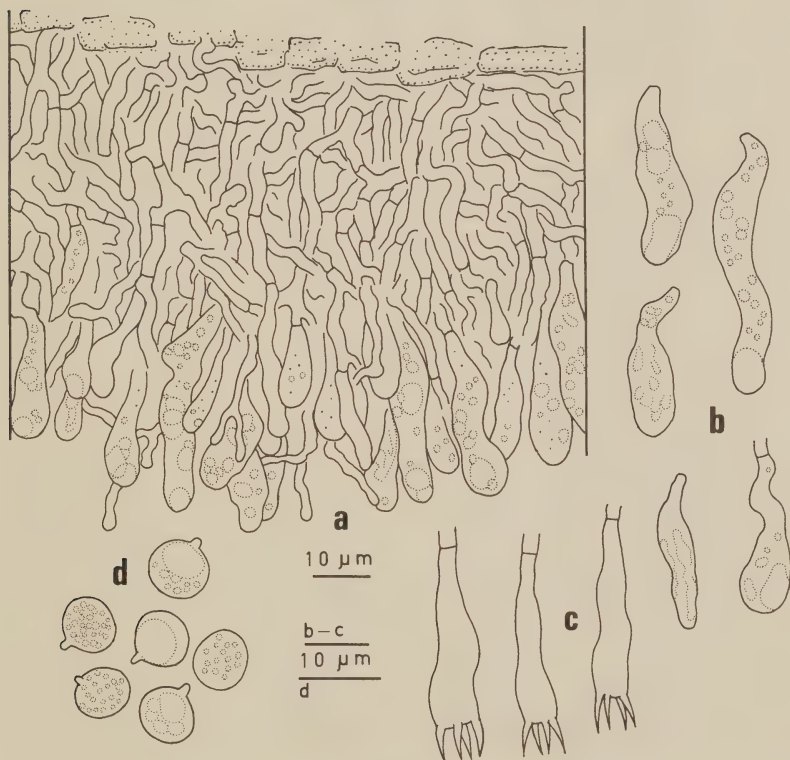


Fig. 19. *Gloiothele citrinoidea* (holotype). a) Fruit body section, b) gloecystidia, c) basidia, d) basidiospores.

Additional specimens examined: Taiwan. Taipei: National Taiwan University campus, on fallen sheath culm of *Livistoma subglobosa*, 7.V.1988, Wu 880507 (N.M.N.S., TAI).

Distribution: Known only from Taiwan.

Remarks: This new species is similar to *Gloiothele citrina*, but can be distinguished from the latter by the larger basidiospores. In contrast to *G. citrina*, fruit body gloeocystidia of this new species are smaller and are SA positive. Moreover, collections of *G. citrinoidea* were made from palms in subtropical Taiwan, while *G. citrina* is species from temperate regions and usually found on coniferous or deciduous wood.

***Gloiothele globosa* S.H. Wu, sp. nov. (Fig. 20)**

Basidiocarpum resupinatum, effusum, membranaceum vel subceraceum, 70-150 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum. Hyphae efibulatae. Gloeocystidia numerosa, tubularia, 4-7 μm diam, SA+. Basidia clavata, 38-52 $\times$ 5.5-7 μm , 4 sterigmatibus. Basidiosporae globosae, laeves, tenuitunicatae, (5.5-) 5.7-6.3 (-6.8) $\times$ 5.2-6 (-6.5) μm , IKI exigue lividae, CB-.

Holotypus: Taiwan. Nantou: Chitou, alt. 1250 m, on branch of *Cryptomeria japonica*, 17.V.1991, Wu 910517-25 (N.M.N.S.).

Etymology: From globosus (= globose), referring to the shape of the basidiospores.

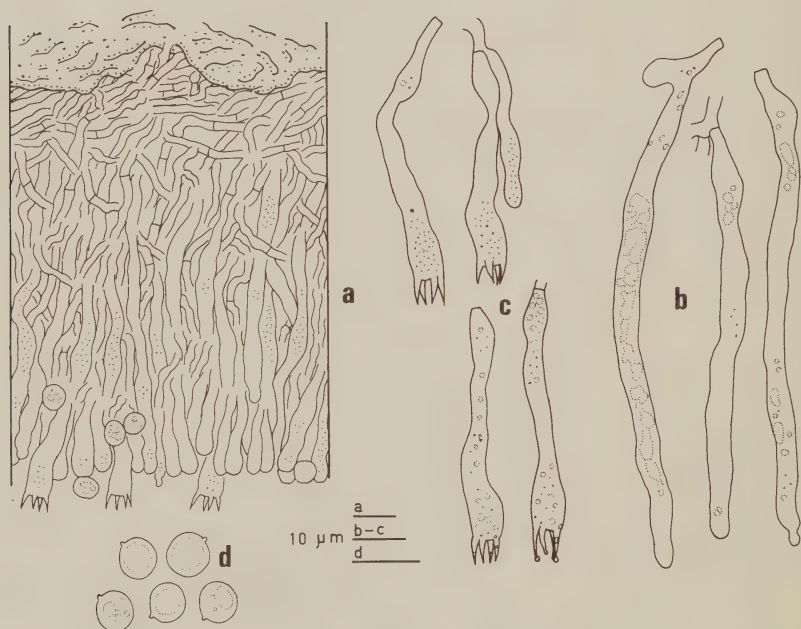


Fig. 20. *Gloiothele globosa* (holotype). a) Fruit body section, b) gloeocystidia, c) basidia, d) basidiospores.

Fruit body resupinate, effuse, adnate, membranaceous or subceraceous, 70–150 μm thick in section. Hymenial surface "yellowish white" (2A2), smooth, occasionally cracked; margin white, thinning, filamentose.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, with dense texture next to substratum and looser near subhymenium; hyphae mainly horizontal especially near substratum, hyaline, sometimes indistinct, 1.5–3 μm diam, thin-walled. Subhymenium $\pm$ thickening, with dense texture. Gloeocystidia numerous, immersed or emergent, hyaline, tubular, occasionally constricted near apices, slightly flexuous, occasionally with a lateral branch near base, up to ca. 120 μm long, 4–7 μm diam, thin-walled, SA+. Basidia clavate or narrowly clavate, irregularly swollen, slightly flexuous, $38\text{--}52 \times 5.5\text{--}7 \mu\text{m}$, 4-sterigmate. Basidiospores globose, smooth, thin-walled, $(5.5\text{--}) 5.7\text{--}6.3 \text{ (} -6.8 \text{)} \times 5.2\text{--}6 \text{ (} -6.5 \text{)} \mu\text{m}$ (holotype SPR: $5.99 \pm 0.27 \times 5.70 \pm 0.30 \mu\text{m}$, $n = 40$), IKI slightly bluish black, CB–.

Cytology: Spores binucleate.

Specimen examined: Taiwan (see type).

Distribution: Known only from Taiwan.

Remarks: This new species is close to *Gloiothele lactescens* in affinity, but differs from the latter in having broader and somewhat shorter basidiospores.

Gloiothele lactescens (Berk.) Hjortst., Windahlia 17:58. 1987 (Fig. 21)

≡ *Thelephora lactescens* Berk. in Smith, Eng. Fl. 5(2):169. 1836.

≡ *Corticium lactescens* (Berk.) Berk., Outlines of British Fungology:274. 1860.

≡ *Gloeocystidium lactescens* (Berk.) Höhn. & Litsch., Wiesner-Festschrift 58:68. 1908.

≡ *Gloeocystidiellum lactescens* (Berk.) Boid., C.R. Acad. Sci. Paris 233:1668. 1951.

≡ *Megalocystidium lactescens* (Berk.) Jül., Persoonia 10:140. 1978.

≡ *Vesiculomyces lactescens* (Berk.) Boid. & Lanq., Mycotaxon 16:493. 1983.

Fruit body resupinate, effuse, adnate, subceraceous or ceraceous, 100–300 μm thick in section. Hymenial surface "light yellow" (4A4) to "pale yellow" (4A3), smooth, occasionally cracked; margin thinning, paler or white, pruinose.

Hyphal system monomitic; hyphae simple-septate. Subiculum indistinctly bilayered, composed of basal layer and medullary layer; hyphae hyaline, 1.5–3 μm diam, thin-walled. Basal layer with compact texture; hyphae mainly horizontal, usually agglutinated. Medullary layer with somewhat loose texture; hyphae variously oriented. Subhymenium thickening, with dense texture. Gloeocystidia numerous, hyaline or slightly yellow, tubular, somewhat flexuous, up to ca. 160 μm long, 6–10 μm diam, slightly thick-walled, SA+. Hyphidia present. Basidia narrowly clavate, sometimes irregularly swollen, guttulate, $40\text{--}55 \times 6\text{--}7 \mu\text{m}$, 4-sterigmate. Basidiospores broadly ellipsoid, adaxially flattened, smooth, thin-

walled, guttulate, (5.5-) 6-7.5 (-8) $\times$ 4.5-5 μ m, IKI slightly bluish black, CB-.

Specimens examined: Taiwan. Taipei: National Taiwan University campus, on decorticated trunk of *Ficus microcarpa*, 12.V.1988, Wu 880512-1 (N.M.N.S., TAI). Taipei: Kungliao, alt. 200 m, on branch of angiosperm, 25.XI.1990, Wu 901125-6 (N.M.N.S., TAI). Kaohsiung: Liukuei, Sanping, alt. 750 m, on decorticated branch of angiosperm, 21.XII.1993, Wu 9312-9 (N.M.N.S.).

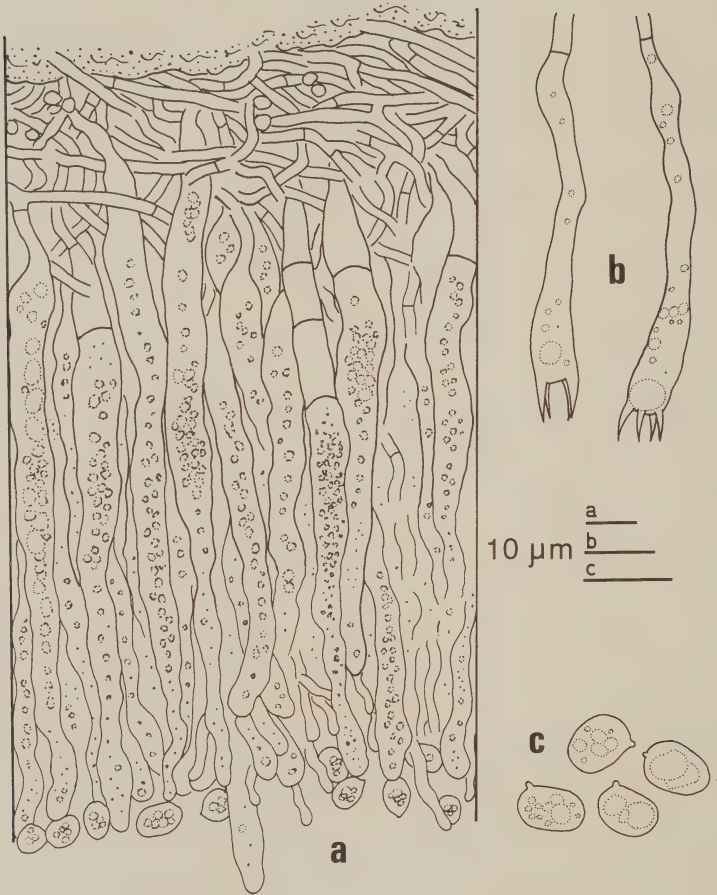


Fig. 21. *Gloiothete lactescens* (Wu 901125-6). a) Fruit body section, b) basidia, c) basidiospores.

Distribution: Pantemperate and subtropical.

Cultural studies: See Boidin (1958), Stalpers (1978) and Nakasone (1990).

Nuclear behavior: Subnormal (Boidin 1958).

Cytology: Spores dikaryotic, MS-mycelium uninucleate, PS-mycelium dikaryotic (Boidin 1958).

Remarks: This species is widely distributed in many temperate and subtropical regions of the world (Freeman 1978). The collections from Taiwan were made only from the lowland subtropical belt. Nakasone (1990) reported that different mycologists have described different cultural features for *G. lactescens*, suggesting that two different taxa may be present under the name *G. lactescens*. This needs to be further considered.

Megalocystidium Jül., Persoonia 10:139. 1978.

Fruit body resupinate, effuse, membranaceous to ceraceous, smooth or slightly tuberculate. Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of medullary layer or basal layer, with somewhat loose or dense texture. Subhymenium usually thickening, with dense texture. Gloecystidia numerous, cylindrical or tubular, SA+. Basidia clavate, fairly long, 4-sterigmate. Basidiospores ellipsoid to cylindrical, smooth or almost so, thin-walled, IKI bluish black, CB-. Nuclear behavior heterocytic.

Remarks: *Megalocystidium* is known as *Gloeocystidiellum* s.l. with clamped hyphae, clavate basidia, and with smooth or minutely verrucose (in *M. montanum* Ginns & Freeman) basidiospores. Species currently recognized in this genus have longer basidia and bigger basidiospores, than those in other genera of *Gloeocystidiellum* s.l. Known nuclear behavior in *Megalocystidium* (*M. leucoxanthum*) is heterocytic. *Corticium luteocystidiatum* Talbot has been treated in *Gloeocystidiellum* (Boidin 1966). This species is considered to belong in *Megalocystidium*, due to its clamped hyphae, smooth basidiospores, and fairly large basidia and basidiospores. A new combination is made below:

Megalocystidium luteocystidiatum (Talbot in Wakefield & Talbot) S.H. Wu, comb. nov.

Basionym: *Corticium luteocystidiatum* Talbot in Wakefield & Talbot, Bothalia 4:941. 1948.

≡ *Gloeocystidiellum luteocystidiatum* (Talbot in Wakefield & Talbot) Boid., Cah. Maboké 4:9. 1966.

Megalocystidium montanum is distinct from other species of this genus by the presence of minutely verrucose basidiospores. Ginns & Freeman (1994) measured basidiospores of *M. montanum* as (8.4-) 9.6-12 (-14) × (4-) 4.4-5.6 (-6) μm, which correspond with those (9-11.5 × 4-5 μm by Wakefield & Talbot 1948; 10-14 × 4-5.5 μm by Freeman 1978) of *M. luteocystidiatum* fairly well. *Megalocystidium luteocystidiatum* known only from the type collection, thus basidiospores can be further checked to confirm their smooth walls.

Key to species of *Megalocystidium*

1. Basidiospores minutely verrucose *M. montanum*
1. Basidiospores smooth 2
2. Basidiospores quite often > 14 μm long *M. leucoxanthum*
2. Basidiospores < 14 μm long 3
3. Basidiospores > 10 μm long *M. luteocystidiatum*
3. Basidiospores < 10 μm long *M. luridum*

Megalocystidium luridum is the only species of this genus known from Taiwan.

Megalocystidium luridum (Bres.) Jül., Persoonia 10:140. 1978. (Fig. 22)

≡ *Corticium luridum* Bres., Fungi trid. 2:59. 1892.

≡ *Gloeocystidium luridum* (Bres.) Höhnelt & Litsch., K. Akad. Wiss. Wien. Math-nat. Kl. 116:770. 1907.

≡ *Gloeocystidiellum luridum* (Bres.) Boid., C. R. Acad. Sci. Paris 233:1668. 1951.

≡ *Vesiculomyces luridus* (Bres.) Boid. & Lanq., Mycotaxon 16: 493. 1983.

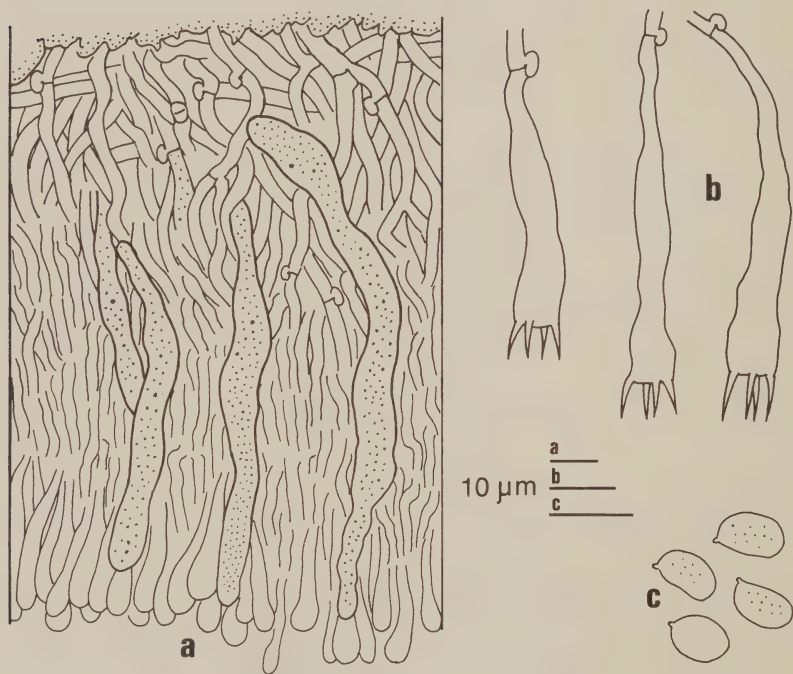


Fig. 22. *Megalocystidium luridum* (Wu 880108-14). a) Fruit body section, b) basidia, c) basidiospores.

Fruit body resupinate, effuse, adnate, subceraceous, 70-250 μm thick in section. Hymenial surface "light orange" (5A4), smooth, occasionally cracked; margin thinning, arachnoid or pruinose, concolorous or paler.

Hyphal system monomitic; hyphae nodose-septate. Subiculum fairly uniform, composed of medullary layer, with somewhat loose or dense texture; hyphae hyaline, irregularly oriented, 2.5-5 μm diam, slightly thick-walled. Subhymenium differentiated from subiculum, thickening, with compact texture; hyphae hyaline, mainly vertical. Gloeocystidia numerous, yellowish, tubular, slightly flexuous, 50-150 $\times$ 6-11 μm , with 0.5-1 μm thick walls, SA+. Basidia clavate, usually tapering to a stalked base, 40-60 $\times$ 6.5-8 μm , 4-sterigmate. Basidiospores ellipsoid, adaxially slightly concave, smooth, thin-walled, with fairly homogeneous contents or with small oil-drops, 6-9 $\times$ 4-5.5 μm , IKI bluish black, CB-.

Specimen examined: Taiwan. Nantou: Yushan National Park, between Kuankao and Patungkuan, alt. 2800 m, 8.I.1988, leg. Y.M. Ju, Wu 880108-14 (N.M.N.S., TAI).

Distribution: European countries (cf. Eriksson & Ryvarden 1975), mainland China (Bi et al. 1993), Japan (Maekawa 1993), Taiwan. Ginns & Freeman (1994) found the specimens of this species from numerous reports in North America, are actually *Megalocystidium leucoxanthum* and *M. montanum*.

Cultural studies: See Boidin (1958).

Sexuality: Heterothallic (Boidin 1958).

Cytology: Spores binucleate, MS-mycelium plurinucleate (Boidin 1958).

DISCUSSION

Basidiome morphology, hyphal system, basidium morphology and spore ornamentation are considered to be features of primary importance in systematics of the *Gloeocystidiellum* s.l., according to the taxonomy developed for corticioid basidiomycetes in recent decades, as well as the studies in this paper. Features such as IKI reaction of basidiome elements, SA reaction of gloeocystidia and hyphal septation, can be generally regarded as of secondary importance. Nuclear behavior in the corticioid basidiomycetes studied mainly by Prof. Boidin for several decades, is demonstrated in this study to be important for delimitating genera in *Gloeocystidiellum* s.l. Nuclear behavior, however, does not appear to be a definitive character above the genus level. Molecular and ultrastructural studies are expected to provide additional information for systematics of this group.

Four of the six species newly recorded from Taiwan are pantemperate in their world distribution. The other two species, *Conferticium heimii* and *Gloeocystidiellum aspellum*, are so far known only from Africa and Taiwan. Such a disjunct distribution accords with the high dispersal capability of corticioid basidiomycetes, as considered by Wu (1990). Thirteen of the fifteen new species were collected from the subtropical and tropical belts of Taiwan. Two new

species of the new genus *Gloeomyces*, however, were collected from warm-temperate - temperate belts of Taiwan. The description of numerous new species in Taiwan is mainly due to poor investigation of this group in other subtropical-tropical regions of the world. Many of the new taxa reported here, are expected to occur in other countries with similar climates. About one third of studied species were new to science in Wu's (1990) studies of three subfamilies of the Corticiaceae in Taiwan. In this study, two thirds of Taiwanese species of *Gloeocystidiellum* s.l. are new taxa, due to poor investigation of this group previously of the world and the more complete survey in this study.

The sulfoaldehyde reaction of gloeocystidia, is best tested on fresh material. It is quite often observed that this reaction becomes negative after storage of a collection for a period of time, probably explaining why negative reactions have been reported for many *Gloeocystidiellum* species (e.g., Burdsall et al. 1981). Larsen & Burdsall (1976) indicated that results of the test are sometimes inconsistent, even for the same specimen.

In this study, specimens were occasionally found to be eaten by invertebrates in the field or in storage. This probably is due to the presence of fragrant gloeocystidia in basidiomes. Therefore, it is important to put specimens in self-sealing plastic bags to avoid invasion by pests.

Tyrosine agar, prepared in this study for testing the presence of tyrosinase, seems to be more sensitive than the use of p-Cresol and L-tyrosine which were recommended by Marr (1979). However, further studies are necessary to prove this.

The use of DAPI as a fluorescent stain in the observation of nuclei in basidiospores and mycelia was practiced in this study as an effective and rapid method. However, this method is more difficult than the Giemsa staining to determine nucleus numbers for cells of clampless hyphae, because the positions of primary septa are quite often difficult to observe.

APPENDIX

New combinations of two foreign species

Two new combinations are proposed, based on studies of specimens including types from foreign countries.

Boidinia inconstans (G.H. Cunn.) S.H. Wu, comb. nov.

Basionym: *Peniophora inconstans* G.H. Cunn., Trans. Roy. Soc. New Zealand 83:263. 1955.

≡ *Gloeocystidiellum inconstans* (G.H. Cunn.) Stalp. & P.K. Buchanan, New Zealand J. Bot. 29:336. 1991.

Specimen examined: New Zealand. Auckland: Coromandel, Whitianga Road, on branch of *Schefflera digitata*, coll. J.M. Dingley, 28.VIII.1954, PDD 13825 (holotype).

Remarks: Recognition of this species in *Boidinia* is based on the presence of

suburniform basidia and aculeate basidiospores. This is the only species in *Boidinia* with encrusted cystidia.

Stereum wakullum (Burdvall, Nakasone & Freeman) S.H. Wu, comb. nov. (Fig. 23)

Basionym: *Gloeocystidiellum wakullum* Burdsall, Nakasone & Freeman, Syst. Bot. 6:431. 1981.

≡ *Vesiculomyces wakullus* (Burdvall, Nakasone & Freeman) Boid., Lanquetin & Gilles, Bull. Soc. Mycol. France 101:355. 1985.

Specimens examined: USA. Florida: Wakulla County, Wakulla River at State Route 98, 3.VIII.1977, Burdsall 9776, on *Taxodium distichum* (holotype, CFMR). Mississippi: Harrison Co., 5.XI.1981, leg. Nakasone, FP 101812 (paratype, CFMR).

Remarks: Recognition of this species in *Stereum* is based on a combination of key features: the presence of acanthophyses, clampless hyphae and smooth basidiospores which are amyloid. Acanthophyses are comparatively sparse in the holotype, and more common in the paratype (FP 101812), but this feature was not mentioned in the protologue and in the study of Ginns & Freeman (1994). Fruit body of this species is strictly resupinate, without the recurved margins of many *Stereum* species. Microscopically, gloeocystidia of this species lack the elongate skeletal-like basal parts which are normally dominant in the context of *Stereum* species. Basal parts of gloeocystidia of this species are stalked or fairly narrow for a certain length, and are slightly brownish and thick-walled as in many other *Stereum* species. Placement of this species in *Stereum* can be confirmed from cultural studies. Nakasone (1990:123) mentioned the resemblance of this species to *Stereum*, because of the development of multiple clamps and fiber hyphae in cultures. In conclusion, *S. wakullum* possesses the diagnostic features of *Stereum*.

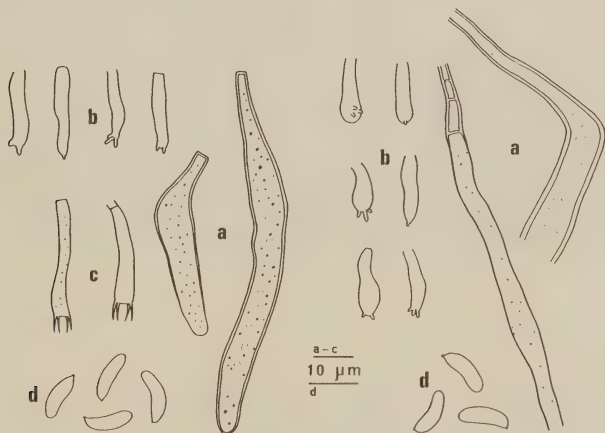


Fig. 23. *Stereum wakullum* (holotype: left; paratype: right). a) gloeocystidia, b) acanthophyses, c) basidia, d) basidiospores.



Fig. 24. SEM of basidiospores. A-B) *Boidinia cana* (holotype), C-E) *B. granulata* (holotype), F) *B. luteola* (holotype), G-H) *Conferticium heimii* (Wu 9209-13), I-J) *Gloeocystidiellum aculeatum* (holotype), K) *G. compactum* (Wu 910619-29), L) *G. formosanum* (holotype). Scale bar = 2 μ m.

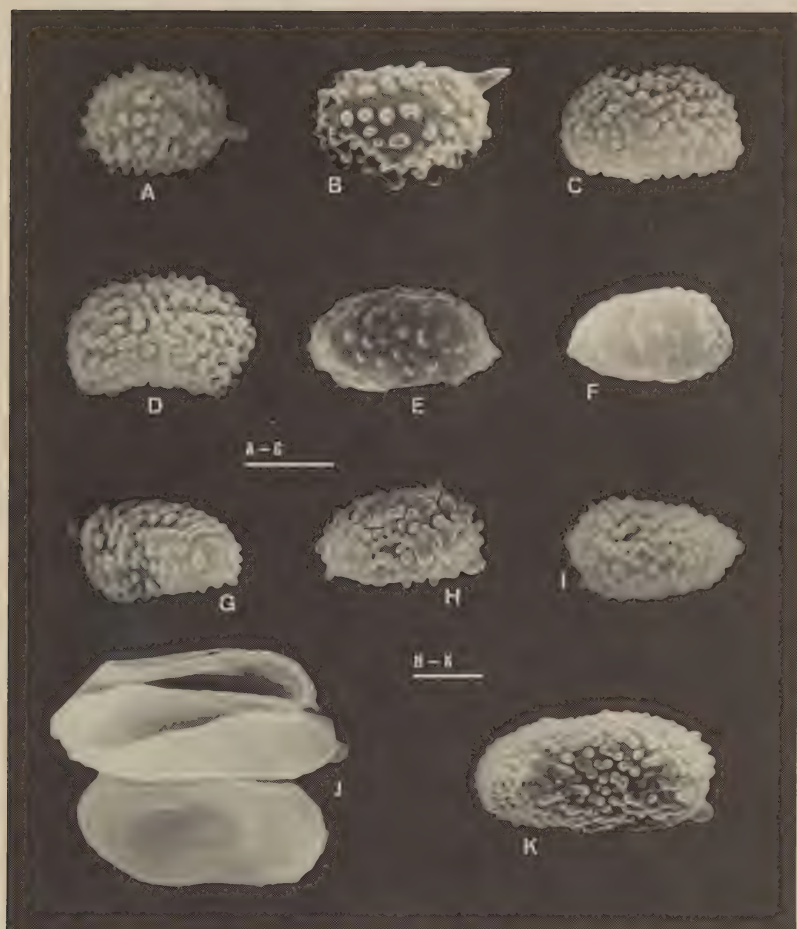


Fig. 25. SEM of basidiospores. A-B) *Gloeocystidiellum laxum* (holotype), C-D) *G. moniliforme* (holotype), E) *G. porosum* (Wu 911206-12), F) *G. purpureum* (holotype), G) *G. tabacinum* (holotype), H-I) *Conferticium ravum* (Wu 9210-107), J) *Boidinia macrospora* (holotype), K) *G. aspellum* (Lin 625). Scale bar = 2 μ m.



Fig. 26. Cultures after 6 wk of growth on 1.5 % MEA at 25 °C. A) *Boidinia cana* (FB-mycelium of holotype), B) *B. granulata* (FB-mycelium of Wu 9209-34), C) *B. macrospora* (PS-mycelium of holotype), D) *Conferticium heimii* (PS-mycelium of Wu 9209-13), E) *C. ravum* (PS-mycelium of Wu 9210-107), F) *Gloeocystidiellum aculeatum* (FB-mycelium of holotype).

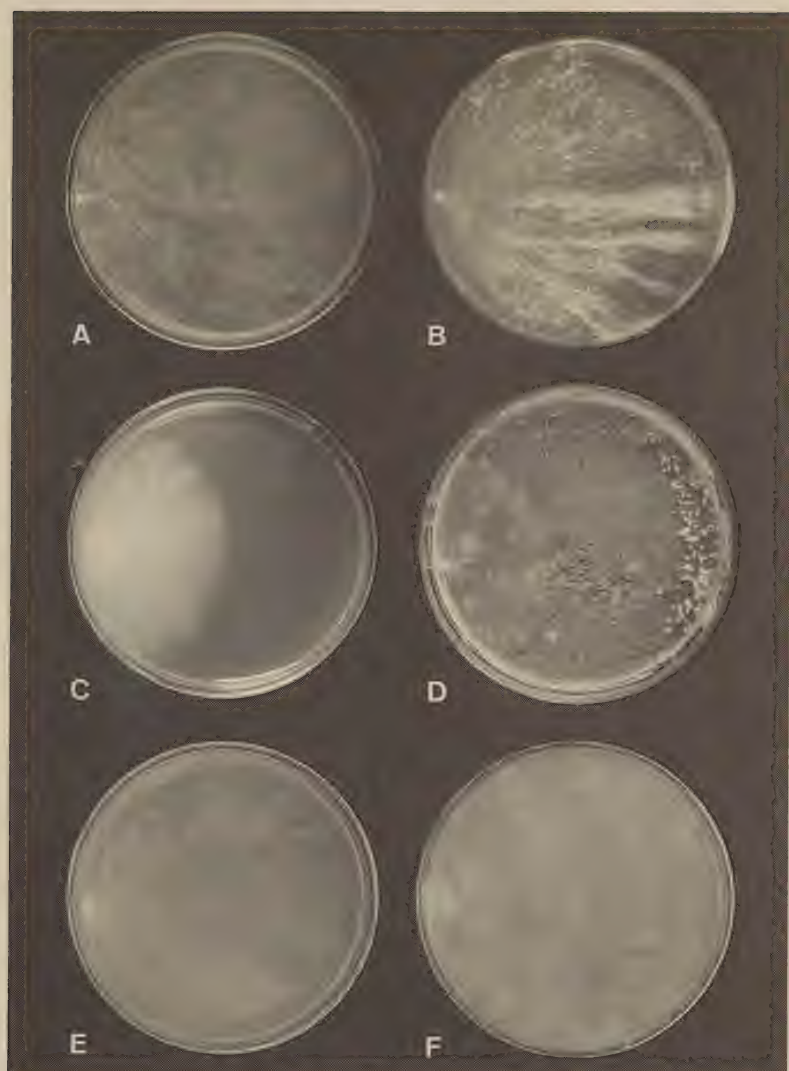


Fig. 27. Cultures after 6 wk of growth on 1.5 % MEA at 25 °C. A) *Gloeocystidiellum aspellum* (SC-mycelium of Lin 625), B) *G. compactum* (FB-mycelium of holotype), C) *G. formosanum* (SC-mycelium of Wu 9404-16), D) *G. laxum* (FB-mycelium of holotype), E) *G. purpureum* (SC-mycelium of holotype), F) *Gloeomyces graminicola* (FB-mycelium of holotype).

ACKNOWLEDGEMENTS

I am much indebted to Prof. J. Boidin, Lyon (France), for offering specimens and valuable suggestions during completion of this study. Drs. P. Buchanan, Auckland (New Zealand), N. Hallenberg, Göteborg (Sweden), and F. Oberwinkler, Tübingen (Germany), are acknowledged for giving constructive suggestions on the manuscript. Thanks are due to curators of CFMR, GB, K, O, PDD and TRTC for arranging loans of specimens including types. This study is supported by National Science Council of ROC (Grant Nos. NSC 81-0211-B-178-01 & 82-0211-B-178-001).

REFERENCES

- Bi, Z., Zheng, G., & Li, T. 1993. The macrofungus flora of China's Guangdong province. Hongkong. 734 pp.
- Boidin, J. 1958. Essai biotaxonomique sur les Hydnés résupinés et les Corticiés. Rev. Mycol. Mém. Hors-Sér. 6:1-388.
- Boidin, J. 1966a. Basidiomycètes Auriscalpiaceae de la République Centrafricaine. Cah. Maboké 4:18-25.
- Boidin, J. 1966b. Basidiomycètes Corticiaceae de la République centrafricaine. I- Le genre *Gloeocystidiellum* Donk. Cah. Maboké 4:5-16.
- Boidin, J. 1984. Répertoire des données utiles pour effectuer les tests d'intercompatibilité chez les Basidiomycètes. VI. Aphyllophorales non porées (Premier supplément). Crypt. Mycol. 11:175-188.
- Boidin, J. & Lanquetin, P. 1983. Basidiomycètes Aphyllophorales épithéloïdes étalés. Mycotaxon 16:461-499.
- Boidin, J. & Lanquetin, P. 1984. Répertoire des données utiles pour effectuer les tests d'intercompatibilité chez les Basidiomycètes. III. Aphyllophorales non porées. Crypt. Mycol. 5:193-245.
- Boidin, J., Parmasto, E., Dhingra, G.S., & Lanquetin, P. 1979. *Stereum* with acanthophyses. Their position and affinities. Persoonia 10:311-324.
- Bourdot, H. & Galzin, A. 1913. Hyménomycètes de France. (IV.-Corticiés: [*Gloeocystidium*]). Bull. Soc. Mycol. France 28:354- 371.
- Bourdot, H. & Galzin, A. 1928 (1927): Hyménomycètes de France. Hétérobasidiés - Homobasidiés gymnocarpes. 761 pp. Société Mycol. France, Sceaux.
- Burdsall, H.H., Jr. & Lombard, F.F. 1976. The genus *Gloeodontia* in North America. Mem. New York Bot. Gard. 28:16-31.
- Burdsall, H.H., Jr., Nakasone, K.K., & Freeman, G.W. 1981. New species of *Gloeocystidiellum* (Corticiaceae) from the Southeastern United States. Syst. Bot. 6:422-434.
- Burt, E.A. 1926. The Thelephoraceae of North America. 14. *Peniophora*. Ann. Missouri Bot. Gard. 12:213-357.
- Capellano, A. & Keller, J. 1978. Architecture de la paroi sporique des Auriscalpiacées et des Hériciacées. Persoonia 9:511-514.
- Chamuris, G.P. 1986. Modification of Nobles' species code for the identification of basidiomycete cultures. Mycotaxon 25:159-160.
- Corner, E.J.H. 1970. Supplement to "A monograph of *Clavaria* and allied genera". Nova Hedw.,

- Beih. 33:1-299.
- Domański, S. 1965. Wood-inhabiting fungi in Białowieża virgin forest in Poland II. The mucronelloid fungus of the *Hericium*-group: *Dentipratulum bialoviesense*, gen. et sp. nov. *Acta Mycol.* 1:5-11.
- Donk, M.A. 1931. Revisie van de Nederlandse Heterobasidiomycetae en Homobasidiomycetae-Aphyllaphoraceae. I. Meded. Ned. mycol. Ver. 18-20:65-200.
- Donk, M.A. 1956. Notes on resupinate Hymenomycetes. III. *Fungus* 26:3-24.
- Donk, M.A. 1964. A conspectus of the families of Aphyllaphorales. *Persoonia* 3:199-324.
- Donk, M.A. 1971. Progress in the study of classification of the higher Basidiomycetes, PP. 3-25. In Petersen, R.H. (ed.), *Evolution in the higher Basidiomycetes*. Knoxville.
- Eriksson, J. 1958. Studies in the Heterobasidiomycetes and Homobasidiomycetes - Aphyllaphorales of Muddus National Park in North Sweden. *Symb. Bot. Upsal.* 16(1): 1-172.
- Eriksson, J. & Ryvarden, L. 1975. The Corticiaceae of North Europe 3. *Coronicium* - *Hyphoderma*. Pp. 285-546. *Fungiflora*, Oslo.
- Freeman, G.W. 1978. The genus *Gloeocystidiellum* with emphasis on North America taxa. Ph.D. Thesis. Univ. Tennessee, Knoxville. 178 pp.
- Gilbertson, R.L. 1974. Fungi that decay ponderosa pine. Pp. 197 Univ. Arizona Press, Tucson.
- Ginns, J. 1992. Reevaluation of reports of 15 uncommon species of *Corticium* from Canada and the United States. *Mycotaxon* 44:197-217.
- Ginns, J.H. & Freeman, G.W. 1994. The Gloeocystidiellaceae (Basidiomycota, Hericiales) of North America. *Biblioth. Mycol.* 157:1-118.
- Hagström, E. 1977. *Vesiculomyces* Hagström gen. nov. segregated from *Gloeocystidiellum* (Corticiaceae). *Bot. Notiser* 130:53-54.
- Hallenberg, N. 1980. New taxa of Corticiaceae from N. Iran (Basidiomycetes). *Mycotaxon* 11:447-475.
- Hallenberg, N. 1981. Basidium repetition in *Conferticium* (Corticiaceae, Basidiomycetes). *Mycotaxon* 12:468-472.
- Hibbett, D.S. 1994. Molecular phylogenetics of polypores. Fifth International Mycological Congress, Abstracts. p. 88.
- Hjortstam, K. 1987a. A check-list to genera and species of corticioid fungi (Hymenomycetes). *Windahlia* 17:55-85.
- Hjortstam, K. 1987b. Studies in tropical Corticiaceae (Basidiomycetes) VII. Specimens from East Africa, collected by L. Ryvarden. II. *Mycotaxon* 28:19-37.
- Hjortstam, K. & Ryvarden, L. 1988. Notes on the Corticiaceae of northern China. *Acta Mycologica Sinica* 7:77-88.
- Hjortstam, K. & Stalpers, J.A. 1982. Notes on Corticiaceae (Basidiomycetes) XI. *Boidinia*, a new genus segregated from *Gloeocystidiellum*. *Mycotaxon* 14:75-81.
- Höhnle, F. & Litschauer, V. 1908. Oesterreichische Corticeen. *Wiesner-Festschr.* 56-80.
- Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. 1990: Index Herbariorum 1. The herbaria of the world. *Regnum Veget.* 120:1-693.
- Jülich, W. 1978. Studies in resupinate Basidiomycetes - V. Some new genera and species. *Persoonia* 10:137-140.
- Jülich, W. 1981. Higher taxa of Basidiomycetes. *Biblioth. Mycol.* 85:1-485. Cramer, Vaduz.
- Jülich, W. 1982. Studies in resupinate Basidiomycetes VII. *Int. J. Myc. Lich.* 1:27-37.
- Karsten, P.A. 1889. Kritisk öfversigt af Finlands Basidsvampar (Basidiomycetes: Gastero- et

- Hymenomycetes). *Bidr. Känn. Finl. Nat. Folk.* 48:1-470.
- Kornerup, A. & Wanscher, J.H. 1978. *Methuen handbook of colour*. 3rd ed. Eyre Methuen, London. 252 pp.
- Larsen, M.L. & Burdsall, H.H., Jr. 1976. A consideration of the term *gloeocystidium*. *Mem. New York Bot. Gard.* 28:123-130.
- Larsson, K.-H. 1994. Poroid species in *Trechispora* and the use of calcium oxalate crystals for species identification. *Mycol. Res.* 98:1153-1172.
- Lin, S.H. & Z.C. Chen. 1990. The Corticiaceae and the resupinate Hydnaceae of Taiwan. *Taiwania* 35:69-111.
- Maekawa, N. 1992. Corticiaceous fungi (Aphyllophorales) collected in Lan-Yu Island, Taiwan. *Rep. Tottori Mycol. Inst.* 30:21-25. 1992.
- Maekawa, N. 1993. Taxonomic study of Japanese Corticiaceae (Aphyllophorales) I. *Rept. Tottori Mycol. Inst.* 31:1-149. 1993.
- Marr, C.D. 1979. Laccase and tyrosinase oxidation of spot test reagents. *Mycotaxon* 9:244-276.
- Mass Geesteranus, R. 1963. Hyphal structures in *Hydnums* 2-4. *Proc. Kon. Nederl. Akad. Wetensch. (Ser. C)* 66:426-457.
- Miller, O.K., Jr. & Stewart, L. 1971. The genus *Lentinellus*. *Mycologia* 63:333-369.
- Nakasone, K.K. 1982. Cultural and morphological studies of *Gloeocystidiellum porosum* and *Gloeocystidium clavuligerum*. *Mycotaxon* 14:316-324.
- Nakasone, K.K. 1990. Cultural studies and identification of wood-inhabiting Corticiaceae and selected Hymenomycetes from North America. *Mycol. Mem.* 15:1-412.
- Nobles, M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. *Can. J. Bot.* 43:1097-1139.
- Oberwinkler, F. 1977. Das neue System der Basidiomyceten. In: Frey, W. et al. (eds.), *Beiträge zur Biologie der niederen Pflanzen*. G. Fischer, Jena, Pp. 59-105.
- Parmasto, E. 1968. *Conspectus systematis Corticiacearum*. 261 pp. *Inst. Zool. Bot. Acad. Sci. Estonicae*, Tartu.
- Parmasto, E. 1994. A cladistic study of a paraphyletic group. *Fifth International Mycological Congress, Abstracts*. p. 166.
- Rattan, S.S. 1977. The resupinate Aphyllophorales of the north western Himalayas. *Biblioth. Mycol.* 60:1-427.
- Rattan, S.S., Abdullah, K. & Ismail, A.L.S. 1978. Studies on fungi causing diseases and decays of trees in Iraq. *Nova Hedwigia* 29:765-779.
- Redhead, S.A. & Norvell, L.L. 1993. Notes on *Bondarzewia*, *Heterobasidion* and *Pleurogala*. *Mycotaxon* 48:371-380.
- Singer, R. 1986. *The Agaricales in modern taxonomy*. 4th ed. Kölitz, Königstein BRD, 981 pp. + 88 pls.
- Stalpers, J.A. 1978. Identification of wood-inhabiting Aphyllophorales in pure culture. *Stud. Mycol.* 16:1-248.
- Wakefield, E.M. & Talbot, P.H.B. 1948. Descriptions of some new Hymenomycetes. *Bothalia* 4:939-949.
- Wu, S.H. 1990. The Corticiaceae (Basidiomycetes) subfamilies Phlebioideae, Phanerochaetoideae and Hyphodermoideae in Taiwan. *Acta Bot. Fennica* 142:1-123.
- Wu, S.H. & Chen, Z.C. 1990. New record of Corticiaceae (Basidiomycetes) collected from the National Taiwan University campus. *Taiwania* 35:64-68.

ALBUGO SPP. ON THE GENTIANACEAE

Michael. J. Priest

Biological and Chemical Research Institute,
NSW Agriculture, P.M.B. 10, Rydalmere,
N.S.W. 2116, Australia.

Summary

Albugo centaurii and *A. swertiae*, two taxa described from hosts in the Gentianaceae, are recognised as separate species on the morphology of the oospores and apparent host differences.

Introduction

Two species of *Albugo* (Pers.) Roussel have been described from hosts in the Gentianaceae in the world. *Albugo swertiae* (Berl. & Kom.) G.W. Wilson was described from the Amur region of Eastern Siberia on *Swertia connata* Schrenk. In the Southern Hemisphere, *A. centaurii* (Hansf.) Cif. & Biga *apud* Biga was described from *Centaureum spicatum* (L.) Fritsch from Mount Kosciusko in New South Wales, Australia. *Albugo centaurii* occurs commonly in eastern Australia on the introduced *Centaureum* spp. In New Zealand, *A. swertiae* has been reported on *C. erythraea* Rafn., *Orphium frutescens* (L.) E.H. May (Dingley, 1969) and, recently on *Eustoma* (McKenzie, 1987) although it was not reported to be present in New Zealand by Baker (1950).

Biga (1955) separated both species on oospore characters and conidial size, but Dingley (1969) synonymised *A. centaurii* under *A. swertiae* on the advice of G.W. Waterhouse who indicated that, on the basis of material of both species she had examined, they were identical.

The appearance of a species of *Albugo* on the commercial flower crop 'Lisianthus', *Eustoma grandiflora* (Rafn.) Shinn. (Gentianaceae) in New South Wales has led to this reappraisal of the two known species of *Albugo* on the Gentianaceae. A description of both species is given below.

Taxonomy

Albugo centaurii (Hansf.) Ciferri & Biga *apud* Biga in *Sydowia* **9**, 355 (1955).

= *Cystopus centaurii* Hansford in *Proc. Linn. Soc. New South Wales* **79**, 97 (1954).

Sori on leaves and stems, creamy-white and erumpent, rounded to elongate, irregularly distributed in leaf spots up to 2.5 cm in diameter. *Conidia* creamy-white in mass, hyaline, cuboid, then ovoid to globose, (13-) 19-22 (-26) x 16-19 μm (average 18 μm), with a thickened equatorial band up to 2.5 μm wide. *Oogonia* hyaline, thin-walled, globose, 72-86 μm in diameter. *Antheridium* single and applied broadly to the oogonial wall. *Oospores* aplerotic, pale golden-brown to deep brown, globose, (38-) 45-55 (-67) μm in diameter, average 52 μm . Oospore wall reticulate with the areolae becoming more irregularly elongated when mature, reticulations up to 4 μm in height (mostly 3 μm), epispore 3-4 μm thick.

Albugo swertiae (Berl. & Kom.) G.W. Wilson in *Bull. Torr. Bot. Club* **34**, 72 (1907).

= *Cystopus swertiae* (Berl. & Kom.) Sacc. & Trotter in *Sacc. Syll. Fungorum* **21**, 858 (1912).

= *Cystopus convolvulacearum* Speg. var. *swertiae* Berl. & Kom. in *Riv. Pat. Veg.* **9**, 26 (1900).

= *Cystopus tragopogonis* (Pers.) Schroeter forma *swertiae* Jaczewski in Komarov, W et Tranzchel, W. *Fungi Rossiae exsiccati* No. 301 (1900).

Sori on leaves, stems and petioles, pale cream in colour, circular in form on leaves, elongated on petioles and stems up to 4mm in diameter. *Conidia* creamy-white in mass, hyaline, cuboid at first, then ovoid to globose, 13-19 x 12-16 μm (average 16 μm) in diameter with a thickened equatorial band up to 1.5 μm (rarely up to 2 μm) wide. *Oogonium* hyaline, thin walled, 44- 60 μm in diameter. *Antheridium* single and in tight contact with the oogonial wall and applied broadly to it. *Oospores* in leaves, sepals and stems, aplerotic, globose, pale golden-brown to deep brown, reticulate, (34-) 36-48 (-52) μm in diameter, average 41 μm , epispore 3 μm thick.

Discussion

When Hansford (1954) erected the species *Cystopus centaurii* he distinguished it from *C. swertiae* on its larger conidia and oospores. Biga (1955) maintained the species separation based on those characters and reported differences in ornamentation of the oospores and, in addition, *C. centaurii* was transferred to *Albugo*. *Albugo swertiae* was described by Biga (1955) as having oospores with ornamentation that was reticulate-papillate, 45-50 μm diam and conidia 11-16 μm in diam. *Albugo centaurii* was described as having oospores that were reticulate-sulcate 50-60 μm in diameter and conidia 18-26 μm in diam.

Examination of the type of *A. centaurii* and many Australian collections has shown that the conidia are of average 18 μm diam. Only one available collection of *A. swertiae* (isotype material) was examined and it had conidia averaging 16 μm . There was also a difference in the equatorial

thickening in both species, that of *A. centaurii* being slightly thicker.

Oogonial size and ornamentation has also revealed several differences in both species. In *A. centaurii* the mature oospores are very dark brown while those of *A. swertiae* appear to remain golden brown. In *A. centaurii* the ornamentation in immature oospores is reticulate but at maturity the areolae become very irregular and elongated (Figure 1a). In *A. swertiae* the ornamentation remains reticulate (Figure 1b). The descriptions of *A. swertiae* (Saccardo, 1912; and the isotype packet label) state that the oospore is reticulate-papillate but examination of the type did not confirm the presence of papillae (G. Waterhouse's notes accompanying the specimen also agree with this finding). The term sulcate used by Hansford (1954) in describing the oospore of *A. centaurii* would appear to be inappropriate here given the definition of sulcate which strictly means "furrows descending into the wall". Such furrows are not present. In size, the oospores of *A. centaurii* average 52µm compared with *A. swertiae* which average 41µm.

These morphological differences are also supported by apparent host and geographical differences. *Albugo swertiae* was described from the Amur region of Russia but does not appear to have been collected since its original description. The recent European literature (Jørstad, 1964; Săvulescu and Rayss, 1930) and Asian and North American regional checklists (Tai, 1979; Ginns, 1986; Farr *et al*, 1989) have failed to reveal any records of a species of *Albugo* on any member of the Gentianaceae in the Northern Hemisphere other than the original description of *A. swertiae*.

The genus *Centaurium* J. Hill is widely distributed throughout the Northern Hemisphere but no species of *Albugo* is recorded on it, in contrast to the Southern Hemisphere where *A. centaurii* is found apparently commonly on the introduced species of *Centaurium* in both Australia and New Zealand.

The genus *Swertia* L. is also widely distributed throughout the Northern Hemisphere through India, China, Japan and America (Chittenden, 1956) but no species of *Albugo* has been reported on any species of *Swertia*. *Orphium frutescens* is a native of South Africa but no species of *Albugo* is recorded on it in South Africa (Wakefield, 1927; Dyer, 1952). In Australia, only the introduced species of *Centaureum* and *Eustoma* have to this time been recorded as hosts of *A. centaurii*. The original description of *A. centaurii* gave the type host as *C. spicatum* (the only native species of *Centaureum* in Australia). Re-examination of the type host has revealed that the original identification was in error and has been re-identified as *C. erythraea* Rafn. (L. Johnson, Herb NSW pers. comm.), an introduced species.

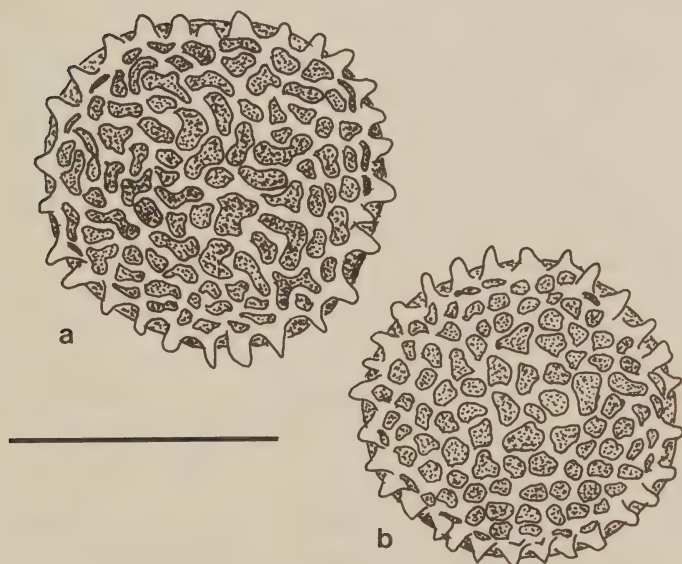


Figure 1 (a). Oospore from type of *A. centaurii*. (b). Oospore from type of *A. swertiae*. Bar = 50 μ m

The available evidence suggests that *A. centaurii* is probably native on the Southern Hemisphere Gentianaceae. It is not conspecific with *A. swertiae* which is known at present from one collection only and does not occur in the Northern Hemisphere on the widely distributed genus *Centaurium* which is its widely recorded host in the Southern Hemisphere. With only one specimen of *A. swertiae* in existence, it appears to be premature to synonymise both species until further collections of *A. swertiae* become available.

Specimens examined

Albugo centaurii: **AUSTRALIA**: New South Wales on *Centaurium erythraea*; Mount Kosciusko, 12 Apr. 1947, A. Costin DAR 4186 Type (host originally as *C. spicatum*), Hawkesbury Agricultural College, Richmond, Sept. 1910, DAR 2189; Oct. 1913, Musson & Whittet DAR 29115; Dec. 1914, Musson & Whittet DAR 57427; Penrose State Forest, Feb. 1976, J. Walker 76/11 DAR 44483; Oberon, Feb. 1954, L. Fraser DAR 4771; Tumbarumba Road, Rosewood, Dec. 1974, J. Walker DAR 25533; on *Eustoma gradiflora*; Quakers Hill, Feb. 1985, E. Maddock DAR 51281; Quakers Hill, Feb. 1985, J. McMaugh DAR 51288; **Victoria** on *C. erythraea*; Somerville, C. French Jr. VPRI 106 (host as *Erythraea australis*); Whittlesea Ranges, Oct. 1911, C. French Jr. VPRI 105; Somerville, Dec. 1899, C. French Jr. VPRI 104; Flinders, Jan. 1902, D. McAlpine VPRI 103; Caulfield, Nov. 1904 VPRI 74, VPRI 75; Healesville, Jan. 1911, D. McAlpine VPRI 67; Buffalo Ranges, Dec. 1904, C. French Jr. VPRI 73; **Queensland** on *C. erythraea*; Brassall, Ipswich, Nov. 1952, A.B. Cribb BRIP 1892 (microscope slide as DAR 55724); **Tasmania** on *C. erythraea*; Conningham, D. Morris DAR 21832; Fern Tree, Nov. 1981, D. Morris DAR 43708; **NEW ZEALAND** on *Orphium frutescens*, Taranaki, New Plymouth, Feb. 1959, T. Mayo ex IMI 95424 (in NY).

Albugo swertiae on *Swertia connata*, Amur Region of Russia, Aug. 1895, Komarov (Fungi Rossiae Exsiccati No. 301) NY (microscope slides as DAR 54976) Type.

Acknowledgements

The curators of NY, BRIP and VPRI are gratefully thanked for loan of specimens in their care. Dr. Geoffrey Hall of the International Mycological Institute, United Kingdom, is thanked for his critical reading of the manuscript.

References

- Baker, S.D. (1950). The genus *Albugo* in New Zealand. *Trans. Royal Soc. New Zealand* **82**: 987-993.
- Biga, M.L. (1955). Riesaminazione delle specie del genere *Albugo* in base alla morfologia dei conidi. *Sydowia* **9**: 339-358.
- Chittenden, F.E. (1956). *Dictionary of Gardening*. Royal Horticultural Society, Oxford. Clarendon Press.
- Dingley, J. (1969). *Records of Plant Diseases in New Zealand*. Plant Diseases Division, DSIR, Bulletin 192.
- Dyer, R.A. (1952). Fungi and Lichens of South Africa. *Bothalia* **5**: 1-1094.
- Farr, D.F., Bills, G.F., Chaminis, G.P. and Rossman, A.Y. (1989). *Fungi on Plants and Plant products in the United States*. American Phytopathological Society. Minnesota.
- Ginns, J.H. (1986). *Compendium of Plant Diseases and Decay Fungi in Canada 1960-1980*. Agriculture Canada Publication 1813, Canada Government Publishing Centre. Ottawa.
- Hansford, C.G. (1954). Australian Fungi. II. New Records and Revisions. *Proc. Linn. Soc. New South Wales* **79**: 97-141.
- Jørstad, I. (1964). The phycomycetous genera *Albugo*, *Bremia*, *Plasmopara* and *Pseudoperonospora* in Norway, with an appendix containing unpublished finds of *Peronospora*. *Nytt Magasin för Botanik* **11**: 47-82.
- McKenzie, E.H. (1987). New plant disease records in New Zealand: miscellaneous fungal pathogens. *New Zealand Journal of Agricultural Research* **30**: 361-366.
- Saccardo, P.A. and Trotter, A. (1912). *Sylloge Fungorum* **21**: 858.
- Săvulescu, Tr. and Rayss, T. (1930). Contribution à la connaissance des Peronosporacées de Roumanie. *Ann. Mycol.* **28**: 297-304.

- Tai, F.L. (1979). *Sylloge Fungorum Sinicorum*. Science Press, Academica Sinica, Peking.
- Wakefield, E.M. (1927). The genus *Cystopus* in South Africa. *Bothalia* **2**: 242-246.

MYCOTAXON

Volume LVIII, pp. 77-92

April-June 1996

A COMPARATIVE STUDY ON *PUNCTELIA COLOMBIANA* AND *PUNCTELIA STICTICA* (PARMELIACEAE, LICHENIZED ASCOMYCOTINA)

Mónica T. Adler

Departamento de Ciencias Biológicas, FCEN-UBA, Piso 4,
Pabellón II. Ciudad Universitaria. 1428 Buenos Aires.
Argentina.

Abstract: The morphology, anatomy and ontogeny of the vegetative propagules of *Punctelia colombiana* and *P. stictica* are described. The morphological traits and environmental requirements of the two species are compared and discussed.

Key words: environment, morphology, ontogeny, propagules, *Punctelia*.

Introduction

Krog (1982), Krog & Swinscow (1977) and Swinscow & Krog (1988) included *Punctelia stictica* (Del. ex Duby) Krog as a valid species in this genus but no data regarding the type of conidia were reported. In Krog's synopsis of the genus (Krog, 1982) only three species were recorded as having filiform conidia: *P. hypoleucites* (Nyl.) Krog, *P. microsticta* (Müll. Arg.) Krog and *P. negata* (Nyl.) Krog. Similarly Stenroos' description of *P. stictica* (Stenroos, 1991) does not describe the conidia present. Nevertheless my examination of pycnidiate collections of this species (Adler, unpublished data) established that it did indeed have filiform conidia as described previously by Nylander (1896).

Since 1982, further species of *Punctelia* with filiform conidia were described: namely *P. colombiana* (Sérusiaux, 1984) which has also recently been recorded from Argentina (Adler, 1989), *P. subalbicans* (Stirt.) D. Gall. & Elix (Galloway & Elix, 1984), *P. nebulata* Elix & J. Johnst., *P. novozelandica* Elix & J. Johnst. (Elix & Johnston, 1988) and *P. jujensis* (Adler, 1989).

The objective of the present work was to compare the closely allied species *P. colombiana* and *P. stictica* (both of which have filiform conidia) and discuss their differences.

Materials and Methods

About 100 collections housed at BAFC, BM, G, GB, H, US, and S were studied. Duplicates of Argentine samples were sent to ANUC, ASU, BM, GB, H, LG, MOR, US and S. Unless

otherwise stated the Argentine specimens are kept at BAFC (numbers in brackets) and were collected by the author, except for those materials collected during 1992 at Sierra de La Ventana (Adler, M.T. & Bertoni, M.D). The abbreviations for herbaria correspond to "Index Herbariorum" (Holmgren et al., 1990).

Morphological observations were made with a Zeiss (SR) dissecting microscope. For routine observations with the light microscope, thallus sections were cut with a razor blade, softened in 5 % KOH and stained with 1% floxin, or KOH was washed away and staining achieved with cotton blue in lactophenol.

Scanning electron microscopy was performed with a Joel SEM JSM-T 100 microscope or with a JEOL JSM- 25 S II. Air dried samples were covered with gold.

Tissue terminology follows Hale (1976). The collection sites were classified climatically following Papadakis (1961, 1980).

Lichen substances were identified through TLC (Culberson & Ammann, 1979) and comparison with authentic samples.

Selected collections examined:

Punctelia colombiana

SOUTH AMERICA. COLOMBIA. Departamento de Antioquia, Medellin, ca. 1800 m, X-1930, Archer (S-holotype); 1 km above San Javier, 1 m from ground on trunk of coffee plant, partly wooded pasture slope, VII-1971, Nee & Mori 4265 (US). **Departamento de Cauca**, near Silvia, 2°35'N 76°25' W, 8000-9000 ft, on dead stunted bushes on slopes of mountains, XII-1967, Garret 54 (BM). **ARGENTINA. Provincia de Jujuy, Departamento Capital**, Lagunas de Yala, c. 24°07'S 65°25'W, 2050 m, II-1986. 2000 m above a lagoon, near a natural forest of *Alnus jorullensis*, on exposed rock, (36397 (dupl. US), 36398, 36400, (dupl. S, H), 36401 (dupl. ANUC, BM)); on *Alnus jorullensis* (36402, dupl. LG). **Provincia de Córdoba Departamento Punilla**, 1,5 km from Copina, 21°20'S, 64°20'W, on rock in canon of a small river, 12-X-1985 (36396). **Provincia de Buenos Aires. Partido de Tandil**, 37°20'S, 59°09'W, Sierra del Tigre, on rock at protected site, IX-1989, (37343, dupl. ASU). **Partido de Tornquist**, Sierra de La Ventana. 38°04'S, 61°59' W. Arroyo de la Garganta del Cerro de La Ventana, on rock near the flood of water, protected site, 17-X-1992 (37294, dupl. MOR; 37295, dupl. LG). Arroyo de los Helechos, on rock, V-1986 (35802).

Punctelia stictica

NORTH AMERICA. USA. California. Humboldt County. On bay oak rocks in pasture. Maple Creek road about 2 mi SE. Korb, 1000 ft., 25-VII-1980. Hale 56876 (US). **SOUTH AMERICA. COLOMBIA.** propre Bogotá. Andes Bogotenses. Weir 13 (BM ex Kew). **ECUADOR. Pichincha.:** Volcán Pichincha, E Slope, along road to antennas at summit, 00°10'S, 78°35'W, 3200-3700 m, roadside páramo and cloud forest, 14-XII-1983, Harris 17059 (BM ex NY). Cerro Iliniza, Eastern slopes, c. 4200 m,

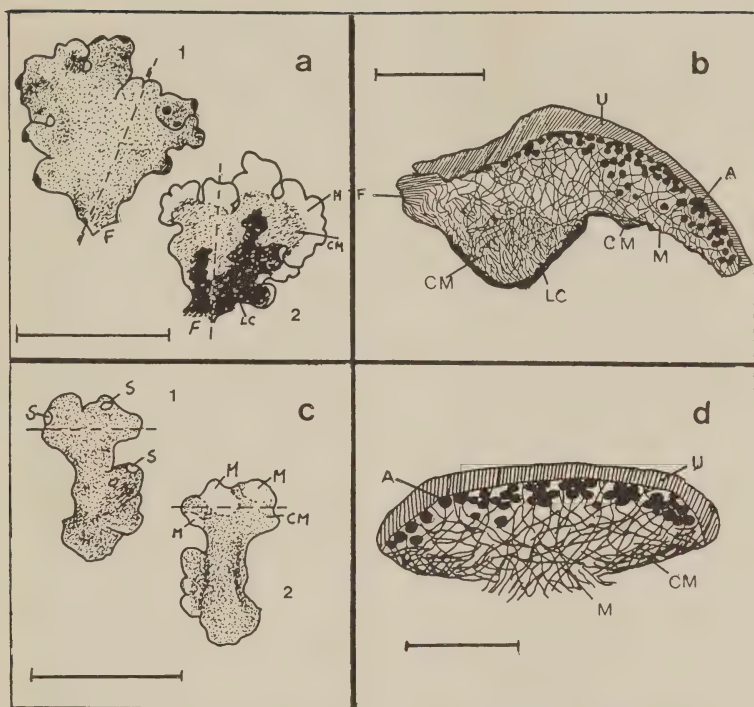


Fig. 1— Mature phyllidia in *Punctelia colombiana*. a) Dorsal (1) and ventral (2) views of a well developed phyllidium in the holotype; broken line= longitudinal section shown in b; scale bar= 0.5 mm. b) Internal structure (schematic) of the phyllidium shown in a): longitudinal section through the broken line; scale bar= 150 μ m. c) Dorsal (1) and ventral (2) views of a well developed phyllidium (BAFC 36397, saxicolous collection, Jujuy Prov., Argentina); broken line= transverse section shown in d); scale bar= 0.5 mm; d) Internal structure (schematic) seen at the transverse section shown by the broken line in c); scale bar= 100 μ m.

F = fixation point of the phyllidium, LC= lower cortex, CM = compact medullary plectenchyma which can form a ventral "pseudocortex", M = exposed lax medullary plectenchyma, U= upper paraplectenchymatous cortex, A = algal layer, S= pseudocyphella open in the phyllidium dorsal side.

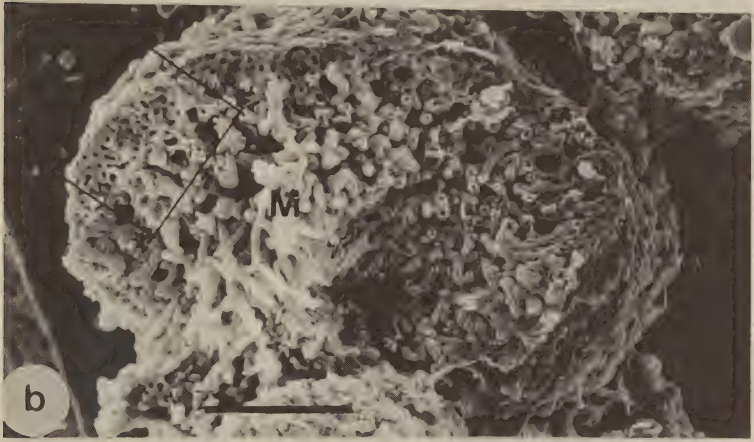
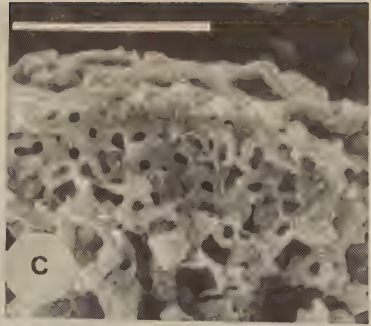
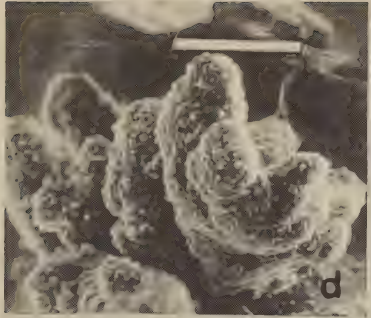
terrestrial in páramo, 7-III-1972, L. Arvidsson & D. Nilson 880 (GB). Road Quito, Chiriboga, near San Juan, c. 3200 m, on soil at roadside, 5-III-1972, L. Arvidsson & D. Nilson 769 (GB). Road Nono, Mindo, ca 10 km NW of Nono, 2500 m, cloud forest, on rocks at road-side. 16-VI-1983, L. & A. Arvidsson 3035 (GB). Eastern slopes of cerro Iliniza, 4200 m páramo, epiphyte on *Chuquiraga* sp., 7-III-1972, L. Arvidsson & D. Nilson 921 (GB). **Napo.** SW slopes of Volcán Antisana, 2-3 km Hacienda El Hato, 5-6 km NNE Laguna Micacocha. Epilithic in grass páramo with open sandy areas, ravines and rock outcrops, 4200-4300 m, 78° 09' W, 0°29' S, 30- VI to 1-VII 1979, B. Lojtnant & V. Molau 15355 ex AAU (GB). Road Quito. Papallacta, 10 km E of the pass; 3500 m. Epiphyt in cloud forest. 24-VI-1983, L. & A. Arvidsson 3596, 3597 (GB). **Cotopaxi.** Parque Nacional Cotopaxi, 00°38' S, 78°26' W, 4100 m, along road from Pampa de Limpios to summit of Cotopaxi, on rock in grass páramo with scattered shrubs, R.C. Harris 17377 (H); Volcán Cotopaxi, northern slopes, alt. 4000 m, páramo, on rock, 12-VI-1983, A. & L. Arvidsson 2703, 2705, 2711, 2726, 2736 (GB); Around Pilalo, 79°02' W, 0°57' S, 30-VI-1968, 2400 m, L. Holm-Nielsen & S. Jeppesen 1069 (S, GB). **Cañar.** At the inca ruins of Ingapirca. Epilithic on rocky slopes and ruderal vegetation, 3200 m, 78°52' W, 2°33' S, 15-VI-1979, B. Lojtnant, A. & V. Molar 14883 ex AAN (GB); road Ingapirca, 5 km W of Ingapirca, alt. 3300 m, dry shrubs, terrestrial, 12-VII-1983, H. Vasquez 4518 (GB). **Azuay.** Road Sayausid, Molleturo, ca 10 km W Sayausid, alt. 3250 m. Shrub vegetation, epiphyte, 15-III-1972, L. Arvidsson & D. Nilson 1100 (GB); ca 3250 m, cloud forest, 15-III-1972, L. Arvidsson & D. Nilson 1523 (GB). **VENEZUELA.** Without substrate data. **Estado de Mérida.** Wooded ravines, elev. 3500-366 m. Along and above east end of Laguna Negra, Sierra Nevada, 8-IV-1975. Hale & López Figueiras 44535 (US); Sierra de Santo Domingo. Páramo de Mucubaji, Hänge nördlich der Passhöhe El Aguila, III-1969. B. & F. Oberwinkler & J. Poelt (US). Páramo with scattered shrubs. El Valle, N of Mérida, 2800 m, 8-II-1974, Hale 43337, 43338 (US); Sierra Nevada de Mérida, above La Aguada. Open rocky hillside and forested ravines, alt. ca 3500 m, 6-II-1974, Hale 43212 (US); Sierra de Santo

Fig. 2- SEM photographs (65 X) of vegetative propagules in *Punctelia colombiana* (BAFC 36402, saxicolous collection from Jujuy Prov., Argentina). a) Primordia of phyllidia emerging from pseudocyphellae on a young part of the thallus. Upper arrow shows a pycnidium ostiole; lower arrow points to the margin of a pseudocyphella. b) Mature dorsiventral "isidioid" phyllidia at older thallus parts. White arrows point to a broken phyllidium: the upper small arrow shows the exposed ventral medullary plectenchyma; the lower big arrow points to the dorsal compact cortical paraplectenchyma. Black arrow points to a semicoralloid dorsiventral phyllidium. Scale bars= 0.5 mm.



Domingo. Páramo de Mucubaji, 3550 m, 25-VII-1958, R.W.Dennis 1976 (BM ex Kew). **ARGENTINA. Provincia de Salta.** Cuesta del Obispo, near Escoipe, 25°02'S, 65°50'W, on small and medium sized stones, place exposed to sun, II-1986 (35944, dupl. ANUC, 37336, 37337, 37341, 37342, 37349). **Provincia de Tucumán.** Valle del Tafi. Carapunco, Infiernillo, 2800 m. On schistose rocks, 23-IX-1947, I. M. Lamb 5399, ex CAN (US). **Provincia de Mendoza.** Las Heras, Quebrada del Chacay, inter 1500-1800 m, 20-VI-1939, Ruiz Leal 6051 (H). **Provincia de Buenos Aires.** Partido de Tandil. Near La Cascada, on granitoid rock, I-1987 (35915, 35917, 36393); XI-1987 (37197). La Movediza, at the base, on granite rock facing to E, I-1987 (35919); XI-1989 (37347). Near Cerro El Centinela, on granitoid wall, facing to SE (35916a, 35916b); XI-1989 (37348). Partido de Tornquist. Sierra de La Ventana. Abra del Pantanoso Viejo, on route 76, on small stones field, place exposed to sun, 17-X-1992 (37305, 37334, 37331). Abra de La Ventana, base of Cerro Bahía Blanca on vertical wall on the route facing to S, exposed site, 16-X-1992 (37296, 37297, 37298, 37303, 37304 dupl. ASU, ANUC (2 coll.), BM, LD, LG, MOR, S, on rock facing to E, 16-X-1992 (37299); on rocky wall facing to SSE, protected site, 16-X-1992 (37300, dupl. US); on rock facing to SE, 16-X-1992 (37301); IX-1989, Scutari (37352); at the base of Cerro de La Ventana, on vertical rocky wall, X-1992 (37345, 37346). Arroyo de los Helechos, V-1986 (35802). **Provincia de Tierra del Fuego.** Isla Grande, Departamento de Ushuaia, Parque Nacional de Tierra del Fuego, on rock at the end of Bahía Lapataia, 54°52'S, 68°35'W, 13-1-1989, T. Ahti & S. Stenroos 47728 (H). **CHILE. Tierra del Fuego. Parque Nacional La Campana,** 32°56'S, 71°08'W, 1000-1400 m. On roadside rocks, 8-XI-1986, Coppins, Galloway, Guzmán & James, 5696 (BM), at 900 m 5620 (BM). **Aysen,** around Coihaique, 300 m, 23-XI-1981, Kashiwadani 18211 (H, S, BM). Canal de Beagle, Yendegaia, on rocks on an almost tree-less hillside, 10-25 m, 2-III-194. R. Santesson 7452 (S). **Territorio de Magallanes:** Río de los Crueros (60 km NNE of Punta Arenas). On exposed sandstone cliffs, 26-IV-1940. Santesson (US). **Valdivia,** 39°45', 73°10'W, on trees *Aesculus hippocastaneus*, 30-XI-1986. Coppins, Galloway, Guzmán & James 5410 (BM). **EUROPE. NORWAY. Opp-**

Fig. 3- SEM photographs of coralloid propagules in *Punctelia colombiana*, BAFC 36400, saxicolous collection, Jujuy Prov., Argentina. **a)** coralloid propagule (200 X) with a broken central branch laying open a reniform, partially radial section; scale bar= 100 μ m. **b)** The central broken branch of the propagule shown in a) (500 X); M= medullary plectenchyma, C= cortical paraplectenchyma; scale bar= 50 μ m. **c)** Detail (1000 X) of the delimited rectangle in b), showing the paraplectenchymatic tissue, scale bar= 25 μ m. **d)** A coralloid, erect, slightly flattened dorsiventral propagule (75 X); scale bar= 0.25 mm.



land, Sör-Fron par., W of For, on rocks in a birch forest, 14-IX-1938, Sten Ahlner, Herb. of Alanko (S); Vågå Ld, Fellese, on stone in meadow-ground, ca. 400 m, 22-6-1937 and 3-7-1948, Sten Ahlner (S). **FRANCE.** Finistère, 2-3 km of Laniscat (ca. 5 km E. Gonarec), on sun exposed rocks at a small stream, 21-VII-1954, R. Santesson 10302 (S); Vire, 35043 H-Nyl (H-isotype). **AFRICA. ETHIOPIA** (Araenna). Mt. Orobo lava flows (Saneti end), 13.600 ft (4500 m), in rock crevice or on mosses over boulder, 22-IX-1971, Tapper 750 (BM). **AFRICA. BASUTOLAND (LESOTHO).** Maseru, Div. Marakabei, 2400-2500 m, south facing basalt escarpment, on mossy rocks, 11-X-1963, Kofler 3101121 (Almborn, Lichenes Africani, H, S, US, BM).

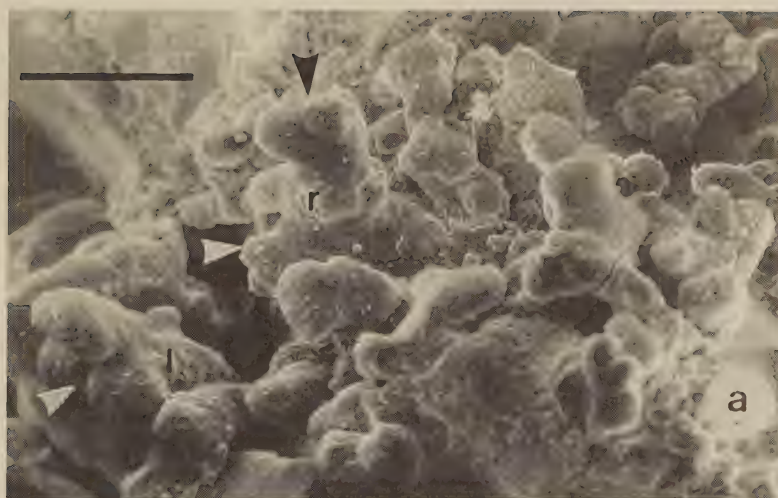
RESULTS

P. colombiana and *P. stictica* share many important taxonomic features: 1) filiform conidia (6.5-) 9-14 (-15) μ m long, less than 1 μ m wide, 2) a black to dark brown lower cortex, 3) a white medulla containing gyrophoric acid, 4) a grey to greenish or strawish grey pseudocyphellate upper surface (pseudocyphellae also marginal) and cortex with atranorin, 5) reproduction mainly by vegetative diaspores originating from pseudocyphellae and 6) infrequent apothecia with 8-spored asci containing hyaline, ellipsoid ascospores, (7-) 9.5-11.5 (-13) $\times$ (13-) 14.5-16 (-18) μ m. The only taxonomically important morphological difference between the two taxa concerns the nature of the vegetative propagules. Whereas *P. colombiana* has squamiform isidia (sensu Du Rietz, 1924) or phyllidia (sensu Hawksworth & Hill, 1984) and coralloid isidia (sensu Du Rietz, 1924) or coralloid-branched phyllidia, *P. stictica* has granular soredia and "isidioid structures" as detailed previously (Swinscow & Krog, 1988).

Punctelia colombiana

This species has been found as being corticolous in the coffee region of Colombia (e.g. Medellín at 1,800 m, with a Tropical frostfree highland climate without a dry season (Humid Tierra Templada); as being corticolous and saxicolous

Fig. 4- SEM photographs (50 X) of mature vegetative propagules in *Punctelia colombiana*, BAFC 35802 (saxicolous collection, Buenos Aires Prov., Argentina). **a)** White arrows point to trichotomic propagules: (l) at left, is constituted by three flattened dorsiventral branches, (r) at right, is constituted by cylindrical branches (black arrow points to an apical pseudocyphella); scale bar= 0.5 mm. **b)** Black arrows point to flattened crenate dorsiventral phyllidia; white arrow points to the same pseudocyphellate erect branch shown in a). Scale bar= 0.5 mm.



in Argentina: Jujuy, c. 2,000 m, in a place with Tierra Friaclimate (Moist Subtropical Tierra Fria) situated in a cloud forest of *Alnus jorullensis*; and as saxicolous in Pampean climates: Córdoba Province (at c. 600 m, Dry Monsoon Peripampean) and Buenos Aires Province (at c. 300 m in Tandil, Cool Humid Pampean and at c. 400 m in Sierra de la Ventana, Frosty Pampean).

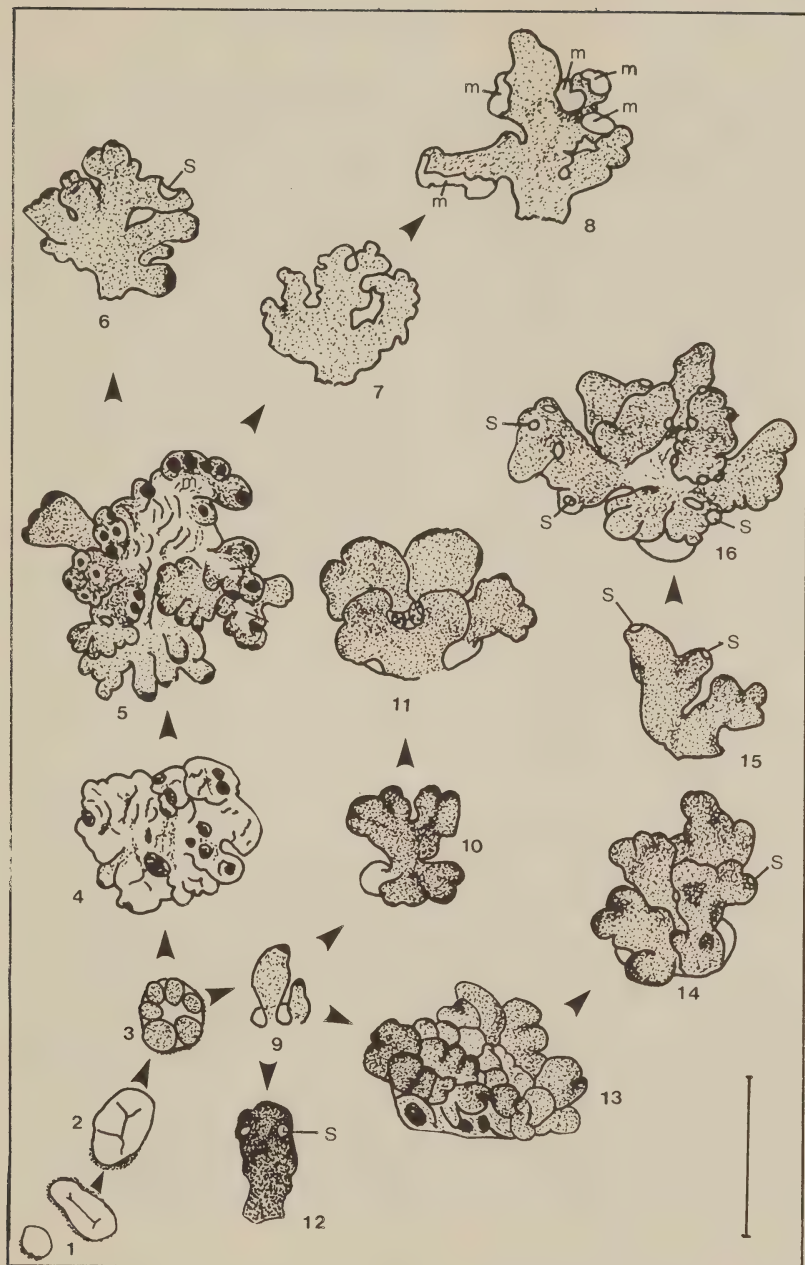
The vegetative propagules, although showing a wide range of forms (Fig. 5), must be interpreted as phyllidia: "... leaf or scale like and dorsiventral structures..." (Hawksworth, 1984) (Fig. 1). Typical phyllidia (Fig. 1 a) predominate in the Colombian specimens whereas the Argentine ones show a predominance of "isidioid" (Fig. 1c, 2b, 4a) and "coralloid" (Fig. 3d) phyllidia. The interrelationship between diverse forms of these propagules has been elucidated through a reconstruction of their ontogeny (Fig. 5): the development of $3 \rightarrow 6$, $3 \rightarrow 8$ and $3 \rightarrow 11$ produces forms of flattened leaf-like phyllidia in Colombian specimens; the development of $3 \rightarrow 16$ produces less flattened isidioid phyllidia in Argentine specimens. In saxicolous collections it is possible to find lobules (Fig. 5 - 12) originating secondarily from the pseudocyphellae through a phyllidial modification. Punctiform pseudocyphellae are frequently formed dorsally (e.g. Fig. 5 - 16) or marginally (Fig. 5 - 15) in the phyllidia. Large marginal pseudocyphellae can also be found (Fig. 5 - 8), some of which occasionally develop small secondary phyllidia (Fig. 5 - 11). The phyllidia of *P. colombiana* are always dorsally corticate with a paraplectenchymatic tissue (Fig. 1 and 3). The ventral cortex is not always well developed which results in partial (Fig. 1a - 2, b, c - 2, d) or complete (Fig. 2b) exposure of the medulla.

Punctelia stictica

This is a species which exhibits a very wide geographic distribution. It is most commonly saxicolous and less frequently terricolous or corticolous on trees and bushes. The specimens studied come from a variety of macroclimatic areas as follows.

Tierra Fria Climates: in Ecuador and Venezuela (eg. Quito, 2,600 m, Moist Monsoon Medium Tierra Fria) but this species was also found at places above 3,500 m in cloud forests or grass páramos for which no certain climatic data are available; in Argentina, Salta Province, 2,000 m (Dry Low Tierra Fria); in Africa, Lesotho, at 2,500 m (Dry Frost Medium Tierra Fria).

Fig. 5- Different forms of phyllidia in *Punctelia colombiana* related ontogenetically. Comments in the text. S= punctiform pseudocyphellae, m= large marginal pseudocyphellae. Scale bar= 0.5 mm.



Pampean Climates: in Argentina, Córdoba (Dry Monsoon Peripampean) and Buenos Aires Provinces (Cool Humid Pampean and Humid Pampean) where *Punctelia stictica* is sympatric with *P. colombiana*.

Marine Climates: in Argentina, Tierra del Fuego Province, Bahía de Lapataia, at 25 m (Humid Cold Patagonian Marine); in Chile (Aysen, at 300 m, Ever Cool Humid Semi-Cold Marine); in Norway, Oppland (Humid Cool Temperate transitional to Continental); in France, Finistère (Ever Humid Cool Marine).

Desert Climates: in Argentina, Tucumán Province (Valle del Tafi, at 2,800 m, Monsoon Medium Tierra Fria Desert) and Mendoza Province (Quebrada del Chacay, at 1,800 m, Patagonian Desert transitional to Pampean).

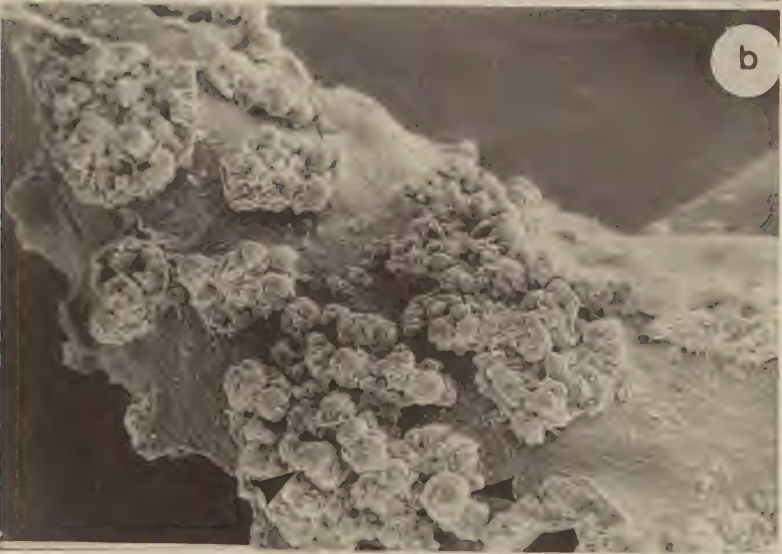
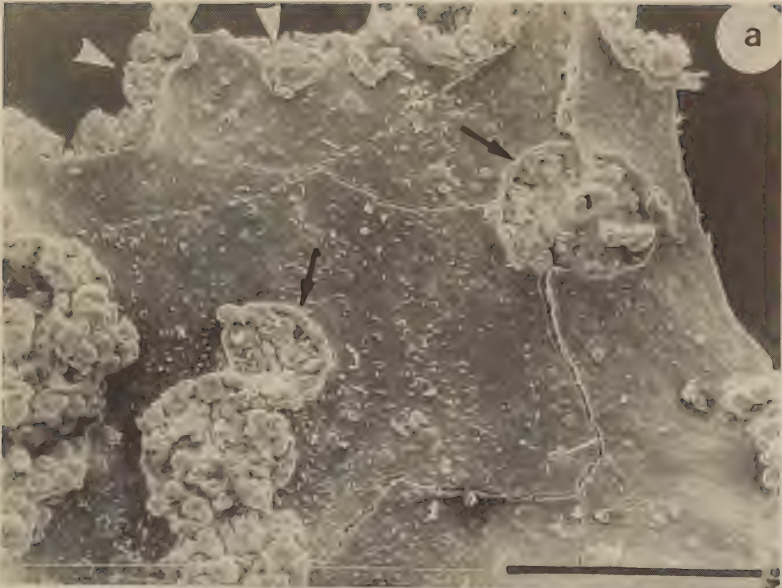
The propagules in *P. stictica* are mainly soredia formed secondarily from the pseudocyphellae (Fig. 5). Occasionally large soredia are found mixed with "isidioid" structures (Fig. 6 b), which are commonly dorsiventral (Fig. 7- 8, 9, 10) and could therefore be considered as small phyllidia. Indeed they sometimes develop pseudocyphellae (Fig. 7 - 11, 12) as do the phyllidia in *P. colombiana*. Frequently these small phyllidia develop into lobules (Fig. 7 - 13), as seen in saxicolous collections of *P. colombiana*.

The variation of morphological features with environmental factors

The brown pigmentation of the upper surface was a feature of almost all of the collections examined, except for the corticolous specimens of *P. colombiana*. The proportion of the thallus tinged with brown was very variable - from almost the complete upper surface to merely the lobe margins. This appeared to depend on exposure to the sun, with exposed specimens from the páramo commonly being completely brown whereas those growing at protected sites were only slightly pigmented. This brown pigmentation is known in other taxa such as *Parmelia saxatilis* Ach. and is considered a possible response to strong illumination and a protection against irradiation (Kappen, 1973).

In both species the pseudocyphellae on the upper surface vary in size, shape and density and appear to be dependant upon microclimatic conditions during the thallus

Fig 6- SEM photographs (75 X) of sorediate pseudocyphellae in *Punctelia stictica*, BAFC 37197 (saxicolous collection, Buenos Aires Prov., Argentina). a) Black arrows point to pseudocyphellae with well defined border and large granular soredia (1 is a small, phyllidium (=isidioid structure); white arrows point to marginal sorediate pseudocyphellae; scale bar= 0.5 mm. b) Mature thallus parts with sorediate pseudocyphellae; black arrows point to small "isidioid structures"; scale bar= 0.5 mm.



development. This would seem to provide a good reason to exclude pseudocyphellae characteristics as diagnostic features at the species level. A good example of this variation is shown in the saxicolous specimen of *P. stictica* grown in an exposed situation near the absolute desert (Tafí del Valle, Tucumán). Here all pseudocyphellae are markedly elevated above the thallus surface, are margined by a thick cortical border and have darkened medulla in the center (Fig. 7 - 6). The shape and width of the lobes are also very variable features in both species, dependent upon microclimatic conditions during thallus development.

CONCLUSIONS

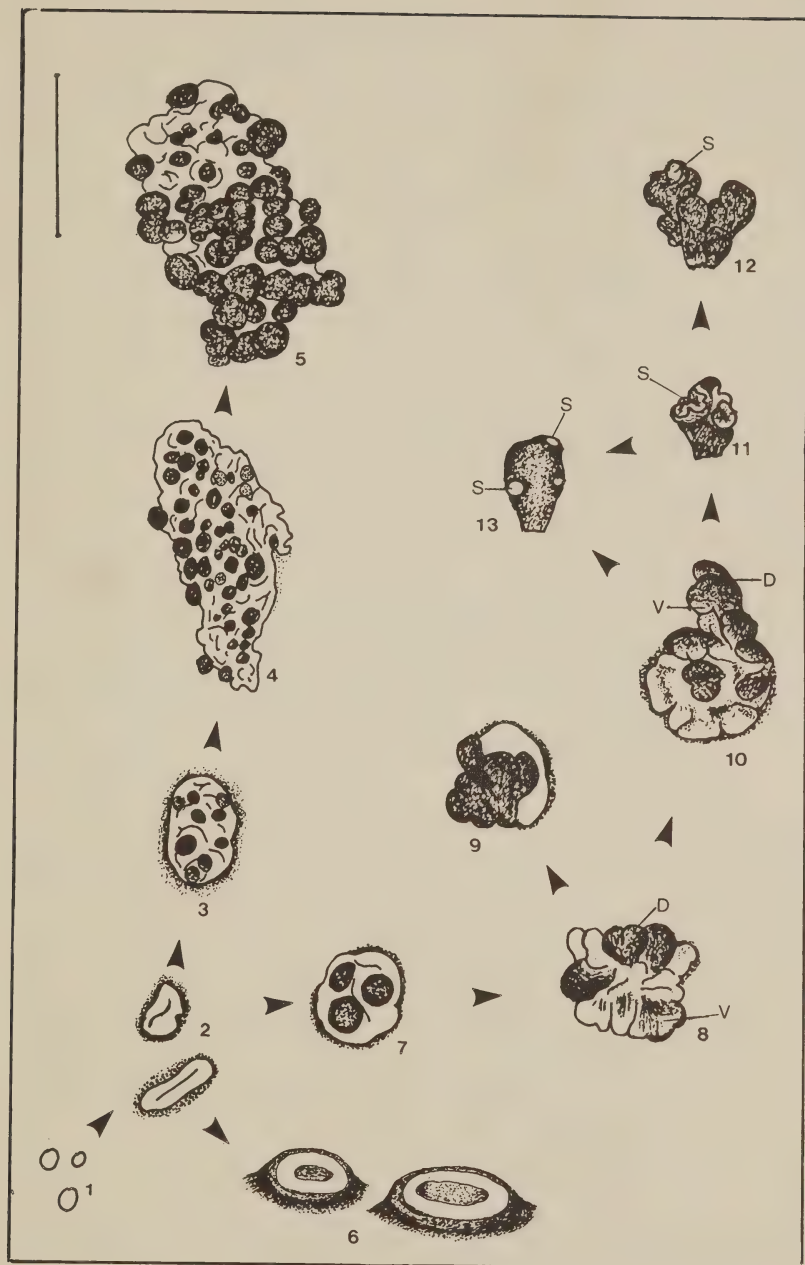
From the above studies it can be concluded that *P. colombiana* and *P. stictica* are two closely related species differing in: 1) the type of vegetative propagules, 2) geographic distribution and 3) macroclimatic preferences. Moreover, field observations in part of the area of sympatry (Buenos Aires Province) showed that the two species appeared to exhibit different habitat preferences: *P. colombiana* growing mainly in protected sites whereas *P. stictica* preferred vertical rock walls and stones in exposed situations. Apparently *P. stictica* is more tolerant to environmental stress.

These differences support the view that *P. colombiana* and *P. stictica* represent two well delimited species, albeit possibly derived from the same parent, *Punctelia jujensis*.

ACKNOWLEDGEMENTS

The author wishes to thank the Curators of the herbaria BM, G, GB, H, S and US for the loan of collections; Dr. J. A. Elix and G. Vobis for the critical reading of the manuscript and their useful suggestions; Dr. E. Ancibor for her advices concerning the anatomical aspects of this work; the Servicio de Microscopía Electrónica de Barrido de la Facultad de Ciencias Naturales y Museo, Universidad de La Plata and the Servicio de Microscopía Electrónica de Barrido de la Facultad de Odontología de la Universidad de Buenos Aires for the SEM photographs; and the Consejo Nacional de Investigaciones Científicas y Técnicas for financing through PID 301360088 and 334400092 and the PRIDHEB).

Fig. 7- Development of propagules in *Punctelia stictica*. Pseudocyphellae in a specimen of extremely dry conditions are also shown (6). Comments in the text. D= dorsal side, V= ventral side, S= pseudocyphella. Scale bar= 0.5 mm.



LITERATURE CITED

- Adler, M.T. 1989. Two new species in Parmeliaceae (Lichenized Ascomycotina) and new records for Argentina. *Mycotaxon* 35:399-404.
- Du Rietz, G. E. 1924. Die Soredien und Isidien der Flechten. *Svensk Botanisk Tidskrift*. 18:371-396.
- Culberson, C.F. & K. Ammann. 1979. Standardmethode für Dünnschicht-cromatographie von Flechtensubstanzen. *Herzogia* 5:1-24.
- Elix, J.A. & J. Johnston. 1988. New species in the lichen family Parmeliaceae (Ascomycotina) from the Southern Hemisphere. *Mycotaxon* 31:491-510.
- Galloway, D.J. & J.A. Elix. 1984. Additional notes on *Parmelia* and *Punctelia*. *New Zealand Journal of Botany* 22:441-445.
- Hale, M.E. 1976. Lichen Structure viewed with the Scanning Electron Microscope. Chapter 1. pp. 1-15. In *Lichenology: Progress and Problems*. D.H. Brown, D. L. Hawksworth & R.H. Bailey eds. Academic Press.
- Hawksworth, D.L. & D.J. Hill. 1984. *The lichen-forming fungi*. Blackie, Glasgow and London. 158 pp.
- Holmgren, P. K., N.H. Holmgren & L.C. Barnett. 1990. Index Herbariorum. 8th ed. Part I.: The herbaria of the world. *Regnum Vegetabile* 120: 1-693.
- Kappen, L. 1973. Response to extreme environments. Chapter 10, pp. 311-380. In *The Lichens*. V. Ahmadjian & M.E. Hale eds. Academic Press.
- Krog, H. 1982. *Punctelia*, a new lichen genus in the Parmeliaceae. *Nordic Journal of Botany*. 2: 287-292.
- Krog, H. & T.D.V. Swinscow. 1977. The *Parmelia borreri* group in East Africa. *Norwegian Journal of Botany*. 24: 167-177.
- Nylander, W. 1896. *Les Lichenes des Environs de Paris*. Paris.
- Papadakis, J. 1961. *Climatic Tables for the World*. Buenos Aires, edited by the author. 177 pp and 7 maps.
- Papadakis, J. 1980. *El Clima*. Editorial Albatros. Buenos Aires. 377 pp.
- Sérusiaux, E. 1984. *Punctelia colombiana* sp. nov. (Parmeliaceae) from South America. *Nordic Journal of Botany*. 4:717-718.
- Stenroos, S. 1991. The lichen genera *Parmelia* and *Punctelia* in Tierra del Fuego. *Ann. Bot. Fennici* 28:241-245.
- Swinscow, T.D.V. & H.Krog. 1988. *Macrolichens of East Africa*. British Museum (Natural History). London 1988. 390 pp..

MYCOTAXON

Volume LVIII, pp. 93-118

April-June 1996

THE GENUS *PHYTOPHTHORA* IN MAINLAND CHINA

H.H. Ho^{1, 2}

¹Department of Biology, State University of New York
New Paltz, New York 12561

ABSTRACT

The study of the genus *Phytophthora* in mainland China was reviewed, with emphasis on the historical background. 26 species of *Phytophthora* (3 new taxa) have been reported in literature and the roles of some major species in causing plant diseases were discussed.

REVIEW

The fungal genus *Phytophthora* was established by de Bary (1876) with *P. infestans* de Bary as the type species. To date, over eighty different species of *Phytophthora* have been described. Most of them are plant pathogens of seed plants and their distribution is world-wide (Zentmyer, 1983), resulting in more than a thousand combinations of host plant and *Phytophthora*, some of which have attained the status of major epidemics (Gregory, 1983).

China is one of the oldest and largest agricultural countries in the world. A knowledge of the occurrence and distribution of *Phytophthora* species and the plant diseases caused by them is not only important for local agriculture but would be of great interest to *Phytophthora* researchers in other parts of the world. Unfortunately, the information was often recorded in Chinese regional periodicals not readily available to foreign scientists. A recent review has been completed by Ho (1990) to provide a synopsis of studies on Taiwan *Phytophthora* in light of current global information on this economically important fungal genus. This paper is a parallel review to provide information on the genus *Phytophthora* in mainland China.

In sharp contrast to Taiwan where the study of *Phytophthora* was initiated and dominated by Sawada resulting in the description of 22 species (16 new taxa)

²Work was done while at the Department of Plant Protection, Nanjing Agricultural University, China as Visiting Professor.

between 1911 and 1959 (Ho, 1990), no single researcher dominated the field in mainland China. Nevertheless, Professor F.L. Tai (1893-1973), as the undisputed Father of Mycology in China was indeed the driving force behind *Phytophthora* research in mainland China. Despite earlier records of *P. infestans* on *Solanum tuberosum* L. in Beijing of Hubei Province and Nanjing of Jiangsu Province (Miyake, 1913; Zhang, 1916; Tsou, 1922) his study on *P. colocasiae* Rac. (Tai, 1923) causing blight of taro, *Colocasia esculenta* Schott in Guangzhou of Guangdong Province is widely accepted as the first investigation of *Phytophthora* in mainland China (Xiang, 1983). He also recorded *P. colocasiae* in Jiangsu Province (Tai, 1927) and *P. melongenae* Sawada for the first time in mainland China (Tai, 1936) and reported *P. infestans* on tomato and potato in Yunnan Province (Tai, 1941). Under Tai's leadership, the Plant Pathology Laboratory at the University of Nanking became pre-eminent in the study of plant diseases resulting in the discovery of six *Phytophthora* species in Jiangsu Province: *P. capsici* Leonian on pepper fruit (*Capsicum frutescens* L.), *P. citrophthora* (Sm. & Sm.) Leonian on apricot trunk (*Prunus armeniaca* L.), *P. colocasiae* on taro, *P. infestans* on potato (*Solanum tuberosum* L.) and *P. melongenae* (= *P. parasitica* Dastur) on eggplant (*Solanum melongena* L.) (Yu, 1940; Wei and Hwang, 1940). Wei (1939) also provided the first description of *P. citrophthora* and *P. parasitica* Dastur as the causal agent for brown rot of sweet oranges in Sichuan Province (Ling, 1941) and studied *P. parasitica* causing tomato fruit rot in Chengdu region (Wei and Chao, 1944). *Phytophthora* diseases were also reported in other parts of mainland, for example, *P. parasitica* on sweet oranges in Guaxi Province (Huang, 1943) and *P. infestans* on potato as well as *P. melongenae* on eggplant in Hunan Province (Wang, 1950).

However, it was the epidemics of late blight of potato throughout the country in the early 50's that brought forth a gush of interests on *P. infestans*. The dominating figure then was undoubtedly Dr. C.K. Lin. He, along with Huang He and Liang Pingyen conducted pioneering studies on the epidemiology and physiology of *P. infestans*. Thus, Lin *et al.* (1955, 1956, 1957), Lin (1961), Lin and Huang (1962), Huang and Lin (1961), Huang (1962), and Huang *et al.* (1984) provided detailed analysis of the disease initiation, spread, survival, forecast and control in the field. Of course, other workers also made important contributions in this regard (Wong and Wu, 1957; Anonymous, 1960; Zhao, 1962; Zhang, 1964; Zhou and Lin, 1965; Zheng, 1980; Lin and Zhou, 1981; Cheng and Chang, 1985; He, 1986; Tsao *et al.* 1964; Xiao *et al.* 1992). To understand the host-pathogen relationship, Liu and Zhang (1962) first determined the conditions affecting the resistance of potato tuber slices while Xiao and Huang (1985; 1986) as well as Jiang and Shen (1985) evaluated the role of rishitin in the resistance of potato to *P. infestans*. Detailed studies of the physiological races of

the pathogen and their virulence towards potato were also conducted (Huang *et al.*, 1981; Tang, 1987; Li, 1992). In the study of the physiology of the fungus, Huang *et al.* (1963) made the most significant contribution by developing a synthetic medium for *P. infestans* and this breakthrough made possible further studies on the nutritional requirements of *P. infestans* and other *Phytophthora* species (Huang *et al.*, 1965; 1980; 1987; Lin and Liang, 1965). By substituting glucose with soluble starch, Liang and Lin (1965) showed that *P. infestans* could not utilize starch as the carbon source and this ability to utilize starch could be used to differentiate other *Phytophthora* species.

The late 50's and early 60's also witnessed the initiation of the study of *Phytophthora* boll rot which caused in many parts of China serious damage to the quantity and quality of cotton, an economically important Chinese crop (Ji *et al.*, 1958; Anonymous, 1961). The pathogen was isolated and studied (Zhang *et al.*, 1963; Deng *et al.*, 1964), but it was Liang (1964) who unequivocally identified it as *P. boehmeriae* Sawada, which also attacked the leaves of ramie in China (Qi *et al.*, 1966; Zhou, 1984; Chen, 1986; Zhou, 1986; He, 1992; Cao *et al.*, 1993). Cotton boll rot disease was prevalent throughout China (Zhang, 1983; 1985; Ding, 1986; Anonymous, 1986; Ma and Shen, 1993) in provinces like Sichuan (Tan and Li, 1988), Hebei (Zhang *et al.*, 1963; Liang, 1964), Anhui (Zhang, 1985), Shaanxi (Qi and Yang, 1989); Shanxi (Liang, 1964; Ji and Fan, 1988; Li *et al.*, 1992), Henan (Liang, 1964; Zhuang, 1981), Jiangsu, Jiangxi (He, 1992), Zhejiang (Zhu, 1982; Ge, 1991), Liaoning and Hubei (Shen and Guo, 1987) as well as Beijing (Liang, 1964) and Shanghai regions (Zhang and Ma, 1980; Zhang and Zhang, 1985). The pathogen survives in soil in the form of Chlamydospores (Zhang *et al.*, 1981) or as oospores (Zheng *et al.*, 1992d; Ma and Shen, 1992; He *et al.*, 1993), and stimulated by exudate of cotton boll (Wu *et al.*, 1993). Cotton seedlings too, are thus susceptible to damping-off by *P. boehmeriae* (Anonymous, 1974a, b; Ji and Li, 1982; Tang, 1990; Ma and Shen, 1993). However, cotton seedling blight in Xinjiang Province was caused by *P. drechsleri* Tucker instead (Jia and Tang, 1989).

As a result of the destructive Cultural Revolution (1966-1976), *Phytophthora* research was virtually suspended during that period, but was resumed immediately in the late 70's, blossoming in the 80's. Firstly, Wang and Lu (1978) described a new pathogen, *P. fragariae* var. *oryzo-bladis* causing leaf blight of rice seedlings early in spring in Jiangsu and Anhui provinces, and Wang and Lin (1979) studied the biology of its zoospores in relation to rice infection. The disease was also reported later in Jiangxi. (Fan, 1981; Yi and Feng, 1986; Xu, 1989), Henan (Hu and Hu, 1988) and Zhejiang provinces (Ding, 1987). Then plant pathologists at Hangzhou Agricultural Department of Zhejiang Province reported (Anonymous, 1978)

epidemics of cucumber blight due to *P. melonis* Katsura. It caused serious damage to cucumber (*Cucumis sativa* L.) and other cucurbits including *C. melo* L., *Citrulus lanatus* L., *Cucurbita moschata* Duch., *Luffa cylindrica* Roem and *Benincasa hispida* Cogn. in provinces like Guangdong (Gao and Huang, 1981; Huang and Qi, 1982; Cheng, 1992), Jiangsu (Lu and Gong, 1982), Zhejiang (Chao *et al.*, 1981), and Gansu (Cheng, 1980), Xinjiang Autonomous Region (Li *et al.*, 1982; 1984; 1986; Wang *et al.*, 1986) as well as Shanghai (Wang and Yang, 1980) and Beijing areas (Li, 1981; Wong and Jiang, 1980; 1982). However, the identification of the cucurbit pathogen was highly controversial. Thus Yu and Zhuang (1982) erected a new species, *P. sinensis* for the pathogen on cucumber whereas Ho *et al.*, (1984d) demonstrated similar morphological and cultural characteristics between *P. melonis*, *P. sinensis* and *P. drechsleri*. Ho (1986) concluded that the pathogen should be assigned to *P. drechsleri* which has priority. The similarity was also noted by Li (1986) and subsequently, the cucurbit pathogen was referred to as *P. drechsleri* (Tang *et al.*, 1990b, 1991a, b; Jia, 1991; Yu, 1993) and the infection process, epidemic factors, and control were studied (Tang *et al.*, 1992a, b, c). In some cases, other *Phytophthora* species were also involved. For instance, *P. parasitica* was recorded on cucumber in Jilin Province (Qi *et al.*, 1966) and Guangzhou region (Cheng, 1980) and *P. capsici* was found on other cucurbits in Xinjiang Autonomous Region (Xie, 1986), Gansu Province (Tang *et al.*, 1990b; 1991b) and Guangdong Province (Cheng, 1992) along with *P. drechsleri* whereas Wang (1988) isolated *P. capsici* from the roots but *P. parasitica* and *P. melonis* from the vines of muskmelons in Xinjiang Autonomous Region.

Fruit rot of pepper caused by *P. capsici* was first recorded by Yu (1940) in Jiangsu Province, but pepper blight described by Qi *et al.*, (1966) in Jilin Province rapidly became a serious threat in many parts of China including Xinjiang Autonomous Region (Anonymous 1982; 1990; Wang *et al.*, 1990a, b; 1993; Pang, 1991; Li *et al.*, 1991; Jia, 1992), Gansu Province (Zhang *et al.*, 1989; Yang and Zhang, 1989; Ren *et al.*, 1990a, b; Tang, *et al.*, 1990b; Shen *et al.*, 1990a), Shaanxi Province (Liang, 1992), Jiangsu Province (Li, 1991), Zhejiang Province (Ge, 1991), Qinghai Province (Zhou *et al.*, 1984), Yunnan, Hunan, Hubei, Guangdong and Jiangxi provinces (Chang, 1990), Liaoning Province (Zheng and Lu, 1990c), Ningxia Autonomous Region (Ma *et al.*, 1992) as well as Beijing (Cheng *et al.*, 1988), and Shanghai districts (Wang and Yang, 1982). *Phytophthora capsici* overwinters in the form of oospores in the soil (Wu *et al.*, 1992; Li *et al.*, 1993). Although it could be transmitted by seeds it lost its viability rapidly (Wang *et al.*, 1990a). Yang and Shen (1992) reported recently on the interesting effects of animal and plant hormones on the growth and sexual reproduction of *P. capsici* whereas the effects of various fungicides on the pathogen were also tested (Zhang *et al.*,

1992; Li and Shen, 1993). The disease could be controlled by membrane pore irrigation (Fan and An, 1990).

Other old diseases, for instance black shank of tobacco due to *P. parasitica* var. *nicotianae*, was known in Sichuan Province (Yu, 1939; Ling, 1941; Anonymous, 1951), Guizhou, Henan, Anhui and Zhejiang provinces (Yu *et al.*, 1955) and especially Shandong Province (Li, 1951; Chen *et al.*, 1963). It received renewed interest in the 80's, especially in the study of its epidemiology (Zhou and Wang, 1984), biotypes (Wang *et al.*, 1985; Zhu *et al.*, 1984; 1987), and physiology (Wang *et al.*, 1989). Pang *et al.* (1985) and Zhou *et al.* (1985) were able to isolate and purify the toxin produced by the pathogen whereas Liu *et al.* (1987) investigated the conditions for its sporangial formation and zoospore release. *Phytophthora cactorum*, first recorded on *Impatiens balsamina* L. in Nanjing (Chu, 1927) and best known as a pathogen of ginseng, *Panax ginseng* C.A. Mey (Qi *et al.*, 1966; Han, 1990; Zhao *et al.*, 1993), apple (Yang and Liu, 1988; Liang, 1991) and pear (Li and Liang, 1980; Tang *et al.*, 1990a) also caused extensive root and fruit rot of strawberry, *Fragaria* sp. (He, 1988; Tang *et al.*, 1990a; Hu, 1990) and found on ramie (Cao *et al.*, 1993).

Phytophthora diseases of citrus was first reported by Reinking (1921) as seedling blight in Southern China. *Phytophthora citrophthora* and *P. parasitica* were later isolated and described as the causal agents for brown rot of sweet oranges, *Citrus sinensis* Osbeck in storage in Sichuan Province (Wei, 1939; Ling, 1941). Collar rot of sweet oranges in Guangxi Province was also attributed to *P. parasitica* (Huang, 1943) which also attacked *Citrus grandis* Osb. in Guangxi Province and *C. nobilis* Lour. in Fujian Province (Tai *et al.*, 1958). However, it was not until the mid 80's when Yu *et al.* (1986a) conducted the first systematic study of *Phytophthora* species on citrus in mainland China and identified *P. citricola* from Sichuan Province, *P. citrophthora* from Sichuan and Hunan provinces and *P. palmivora* from Hunan Province. You (1988) found that citrus collar rot in Hunan Province was caused by *P. citrophthora* and *P. palmivora*. Zheng (1989) reported six species of *Phytophthora* from Sichuan Province: *P. boehmeriae*, *P. cactorum*, *P. citricola*, *P. citrophthora*, *P. palmivora* MF4 and *P. parasitica*. Zhu *et al.* (1989; 1993) distinguished five species causing citrus foot rot: *P. parasitica*, *P. melonis*, *P. palmivora*, *P. citrophthora*, and *P. cactorum*; Zhang *et al.* (1993) identified *P. parasitica*, *P. citrophthora* and *P. capsici* from citrus trees in Hainan and Zhanjiang. Citrus brown rot in Jiangsu Province was caused by *P. citrophthora* and *P. citricola* (Liu, 1988) but by *P. citrophthora* in Zhejiang Province (Ge, 1991). Root rot and yellow leaf disease of citrus in Jiangsu and Hubei provinces was due to *P. parasitica* (Liu and Yin, 1993). Seedling damping-off was also caused by *Phytophthora* spp. (Xu, 1988; Zhu and Chen, 1990), including *P. nicotianae* var. *parasitica*, *P. citrophthora* and *P. palmivora* (Cheng

et al., 1989).

In 60's. rubber trees in many plantations in the southern provinces, especially Yunnan, suffered from leaf fall, stem canker and black stripe. The disease was attributed to *P. heveae* and *P. meadii* (Tai, 1979) but detailed information on the causal agents was lacking. Ho *et al.* (1984a) studied the isolates of *Phytophthora* from plantations in Xishuangbanna of Yunnan Province and found that *P. citrophthora* was by far the commonest species from leaves, bark, fruit and soil whereas the other species were *P. palmivora* from leaves and soil. *P. cactorum* from leaves and *P. colocasiae* from soil although Yang and Liu (1985) found no pathogenicity of the latter to *Hevea* by artificial inoculation. Yu *et al.* (1986b) expanded the study to include Hainan Island and confirmed the predominance of *P. citrophthora* which is the major pathogen in rubber plantations in China. In addition to *P. palmivora* and *P. cactorum*, *P. capsici* was found for the first time on *Hevea* rubber.

Several new *Phytophthora* species, hitherto unreported, also appeared in mainland China in the past decade. Thus *P. vignae* Purss was reported on *Vigna Sesquipedalis* (L.) Fruw, resulting in dead vines in Guangzhou region (Huang and Qi, 1984), Zhejiang, Jiangsu and Anhui provinces (Yang *et al.*, 1989; Zhu *et al.*, 1990). Zheng and Lu (1989b) isolated *P. botryosa* Chee from the leaves of *Colocasia esculenta* in Fujian Province, and *P. cryptogea* Pethybr. & Laff. from the roots of *Cedrus deodara* Loud. in Nanjing. *Phytophthora palmivora* (Butler) Butler, first recorded as an isolate from an unnamed tropical plant in Guangdong Province (Liang and Lin, 1965; Lin *et al.*, 1981) was identified by Ho *et al.* (1983a) as the pathogen attacking the leaves of chives, *Allium tuberosum* Rottler in Beijing region; *P. citricola* was found on citrus (Zhuang, 1981; Ho *et al.*, 1984e); *P. meadii* McRae was reported on the roots of *Euonymus japonicus* L. in Hangzhou and Nanjing (Zheng and Lu, 1988); *P. porri* Foister was reported on onion in Shanghai region (Zhu *et al.*, 1990); *P. cyperi* (Ideta) Ito was described on *Cyperus malaccensis* Lam. var. *brevifolius* Bocklr. in Guangxi Province (Tai and Zhang, 1989; 1990; Zhang and Tai, 1992). The pathogen causing the dying-back of many black locust trees (*Robinia pseudoacacia* L.) in Jiangsu Province as a result of stem rot or bark canker deserves special mention. It was initially identified as *P. cinnamomi* Rands (Huang and Wang, 1983) but since the isolates were different in some respects from other known typical isolates of *P. cinnamomi*, they were treated as atypical forms of *P. cinnamomi* (Ho *et al.*, 1983b). Later, another new isolate was assigned to *P. richardiae* Buisman (Li and Yu, 1987) or *P. robinicola* Lu, Xu & Fang sp. nov. whereas other isolates were identified as *P. drechsleri* and *P. nicotianae* (Xu *et al.*, 1990a). Shen *et al.* (1990b) also identified the pathogen causing blight of black locust seedlings in Beijing region as *P. cinnamomi*. The

precise identification of the pathogen on black locust requires further comparative studies.

Phytophthora megasperma Drechs. *sensu lato*, long considered to be absent in China was reported on *Asparagus officinalis* L. in Fujian Province as *P. megasperma* var. *sojae* Hild. (Chen *et al.*, 1989) and soybean in Heilongjian Province (Shen and Su, 1990; 1991), and the isolate in the latter case could also be entered as *P. sojae* Kauf. & Gerd. (Yu, 1993). Although Shen and Siang (1948) reported *P. megasperma* as a saprophyte on submerged branches and fruits in Hebei and Yunnan provinces, it was reclassified as *P. gonapodyides* (Petersen) Buisman by Sparrow (1960). Hu (1990) stated that *P. fragariae* causing red core of strawberry occurred sporadically but no published literature could be located. The *Phytophthora* species reported to date in mainland China are summarized in Table 1.

Table 1: *Phytophthora* species recorded in mainland China listed chronologically

- P. infestans* (Montague) de Bary (Miyake, 1913)
- P. colocasiae* Raciborski (Tai, 1923)
- P. cactorum* (Lebert & Cohn) Schroeter (Chu, 1927)
- P. melongenae* Sawada (Tai, 1936)
(=*P. nicotianae* Breda de Haan)
- P. citrophthora* (Smith & Smith) Leonian (Wei, 1939)
- P. parasitica* Dastur (Wei, 1939)
(=*P. nicotianae* Breda de Haan)
- P. parasitica* Dastur var. *nicotianae* Tucker (Yu, 1939)
- P. capsici* (Yu, 1940)
- P. megasperma* Drechsler (Shen and Siang, 1948)
(=*P. gonapodyides* (Petersen) Buisman)
- P. boehmeriae* Sawada (Liang, 1964)
- P. palmivora* (Butler) Butler (Liang, 1964)
- P. fragaria* var. *oryzo-bladis* Wang & Lu (Wang and Lu, 1978)
- P. melonis* Katsura (Anonymous, 1978)
(=*P. drechsleri* Tucker)
- P. sinensis* Yu & Zhuang (Yu and Zhuang, 1982)
(=*P. drechsleri* Tucker)
- P. nicotianae* Breda de Haan (Ho *et al.*, 1983a)
- P. cinnamomi* Rands (Huang and Wang, 1983; Ho *et al.*, 1983b)
- P. drechsleri* Tucker (Ho *et al.*, 1984b, c, d)
- P. citricola* Sawada (Ho *et al.*, 1984e)
- P. vignae* Purss (Huang and Qi, 1984)
- P. richardiae* Busisman (Li and Yu, 1987)
- P. meadii* McRae (Zheng and Lu, 1988)
- P. botryosa* Chee (Zheng and Lu, 1989b)
- P. cryptogea* Pethybridge & Lafferty (Zheng and Lu, 1989b)
- P. megasperma* Drechsler var. *sojae* Hildebrand (Chen *et al.*, 1989)
- P. cyperii* (Ideta) Ito (Tai and Zhang, 1989)
- P. robinicola* Lu, Xu & Fang (Xu *et al.*, 1990a)
- P. porri* Foister (Zhu *et al.*, 1990)

P. megasperma Drechsler (Shen and Su, 1990)
(= *P. sojae* Kaufman & Gerdemann)

Throughout the history of *Phytophthora* research in mainland China, three centers of excellence distinguished themselves, two in Beijing and one in Nanjing. At the Department of Plant Protection, Beijing Agricultural University, Dr. C.K. Lin and Liang Pingyen laid down the foundation for the study of epidemiology (Lin *et al.*, 1955; 1956; 1957; Lin, 1961; Lin and Huang, 1962; Liang, 1964) and nutritional requirements of *Phytophthora* (Lin and Liang, 1965), with special emphasis on *P. infestans* and *P. boehmeriae*. The starch utilization medium developed by Liang and Lin (1965) continued to be used by other Chinese workers in the identification of *Phytophthora* species. Their pioneering work on *Phytophthora* was continued by Shen Chongyao, a member of the International Society of Plant Pathology *Phytophthora* committee. The focus of research was on the identification and biological characteristics of the pathogen (Shen and Guo, 1987; Shen and Su, 1990; 1991; Shen *et al.*, 1990a, b; Liu *et al.*, 1989a; Ma and Shen, 1993). Of special interest is the discovery of *P. megasperma* on soybeans from Heilongjiang and Jilin provinces as well as Beijing area (Su, 1991) and the development of a new V-6 medium (Liu *et al.*, 1989b) to replace the V-8, widely used by *Phytophthora* researchers but difficult to obtain in mainland China. Shen and his students also began to develop other frontiers in *Phytophthora* research. Thus Dou and Shen (1993) used ELISA for rapid detection of *P. megasperma*, whereas Yang (1992), Yang and Shen (1992) studied the stimulating effects of plant and animal hormones on the sexual reproduction of *P. capsici* as well as the soluble protein patterns and isoenzymes of its mating types. For disease control, the sensitivity of *P. capsici* to propamocarb and metalaxyl was investigated (Li and Shen, 1993) and the possibility of using *Pythium oligandrum* as a biological control of *P. megasperma* was explored (Su and Shen, 1993).

At the Institute of Microbiology, Academia Sinica at Beijing, Huang He established himself early in the 1960's as a major player in the study of *Phytophthora* physiology by developing a synthetic medium for fastidious *P. infestans*, (Huang *et al.*, 1963). He further demonstrated that the fungus, although almost unable to assimilate nitrate, could utilize ammonium salt as the nitrogen source, provided sufficient calcium and an organic acid were available and the amount of mycelial growth of *P. infestans* was similar to that obtained on natural media (Huang *et al.*, 1965). The organic acid might serve as a precursor for amino acids and the synthetic medium also supported luxuriant growth of other *Phytophthora* species (Huang *et al.*, 1987). To facilitate the storage of cultures of *Phytophthora* species, Xu and Huang (1987) developed a simple apparatus for preserving them in liquid nitrogen at ultra-low temperatures and found the viability

of most cultures could be maintained for at least five years (Huang and Xu, 1993). Beginning in the early 80's. Yu Yongnian, a distinguished mycologist. noted especially for his work on *Pythium*, turned his attention to *Phytophthora*. with equal eminence. His research group conducted the first study of the mating types of the heterothallic species in *Phytophthora* known in mainland China at that time (Ho *et al.*, 1983a, c). He and his co-workers provided the most comprehensive studies of citrus and *Hevea* rubber (Ho *et al.*, 1984a; Yu *et al.*, 1986a, b). The master thesis and doctoral dissertation of his students, Zhuang Wenying (1981) and Li Jinliang (1985) stand, respectively, as the first and the most complete taxonomic treatment of the genus *Phytophthora* to date in mainland China. Yu (1993) compiled a list of *Phytophthora* species and their hosts as well as geographical distribution in China and believed that *Phytophthora* should be placed in the family Phytophthoraceae instead of Pythiaceae as usually accepted by most mycologists (Yu and Liu, 1990).

At the Department of Plant Pathology, Nanjing Agricultural University (formerly. Plant Pathology Laboratory, University of Nanking), the seed of *Phytophthora* research was sown early by C.T. Wei and Dr. T.F. Yu resulting in the elucidation of *Phytophthora* diseases in Jiangsu and Sichuan provinces (Yu, 1940; Wei, 1939; Wei and Hwang, 1940). Then, Lu Jiayun became interested in *Phytophthora* diseases in the late 70's and described *P. fragariae* var. *oryzo-bladis* as a new pathogen causing rice seedling blight in Jiangsu Province (Wang and Lu, 1978). As the Director of Plant Pathogen Institute, she has special interest in the identification and biology of *Phytophthora* species causing plant diseases (Lu *et al.*, 1984). Thus the causal agents of cucumber blight (Lu and Gong, 1982; Ho *et al.*, 1984d) and the blight of *Cedrus deodara* seedlings (Ho *et al.*, 1984c; Xu *et al.*, 1990) in Nanjing were determined. Xu Jingyou conducted a detailed study of the trunk rot of black locust in Jiangsu Province and concluded that *P. robinicola* sp. nov. was the single most important pathogen (Xu *et al.*, 1990a) distinguished not only by morphological characters but also by electrophoresis patterns of soluble proteins and esterases (Xu *et al.*, 1993). Zheng Xiabo studied the root rot disease of *Euonymus japonice* L. in Nanjing (Zheng and Lu, 1988d), compared the characteristics of numerous isolates of *P. nicotianae* from China (Zheng and Lu, 1989a) and performed comprehensive survey of *Phytophthora* species in Fujian, Zhejiang and Jiangsu provinces (Zheng and Lu, 1989b) as well as Liaoning and Heilongjiang provinces (Zheng and Lu, 1990c). To facilitate the production of sporangia needed for species identification, Zheng and Lu (1990b) developed a technique utilizing millipore-filtered soil leachate. But it was the determination of the mating types of heterothallic *Phytophthora* species primarily from Nanjing (Ho *et al.*, 1984b; Lu *et al.*, 1984) that stimulated Lu's special interest in sexual reproduction

and the genetics of *Phytophthora* (Xu *et al.*, 1991). The geographical distribution of the mating types of *P. cinnamomi* in Fujian, Zhejiang and Jiangsu provinces (Lu and Zheng, 1988) and eleven *Phytophthora* species in East and Northeast China was determined (Zheng and Lu, 1990a). The large collection of both heterothallic and homothallic isolates of *P. drechsleri* from Nanjing area also served as the focal point for genetic investigation into the nature of sexuality of this species (Wang and Lu, 1988). As a prerequisite for the study of inheritance, techniques were developed for single zoospore isolation (Zheng and Lu, 1991) and oospore germination (Zheng *et al.*, 1991; 1993). Subsequently, the inheritance of biological characters and mating types in *P. drechsleri* were investigated (Zheng and Lu, 1992a, b; Zheng *et al.*, 1992a). The selection of mating pairs with double-marker, resistant and sensitive to drugs (Zheng *et al.*, 1992b) also permitted the study of sexual behavior in *P. drechsleri* (Zheng *et al.*, 1992c).

In retrospect, it is worth pointing out that nearly all the major *Phytophthora* researchers in China were the first, second or third generation of students of Professor F.L. Tai:

F.L. Tai --- C.K. Lin¹ ---- Liang Pingyen¹
(1893-1973)

Shen Chongyao¹ -- Yang Yijun¹
Su Yanchun¹
Huang He²

Yu Yongnian²---Zhuang Wenying²
Li Jinliang²

C.T. Wei³ --- Lu Jiayun³ ----- Xu Jingyou³
Zheng Xiabo³

T.F. Yu³

¹Department of Plant Protection, Beijing Agricultural University

²Institute of Microbiology, Academia Sinica, Beijing

³Department of Plant Protection, Nanjing Agricultural University

The enormous size of mainland China, the wide range in climates, and the abundance and diversity of crops together would lend this region a fertile ground for the study of *Phytophthora* diseases. This is well illustrated by the recent report (Zhang *et al.*, 1994) that a thorough study of *P. colocasiae* from Hainan Island has revealed three mating types, suggesting that Hainan is inside the center of origin of *P. colocasiae*. On the other hand,

Zhou *et al.* (1992) found that the 131 isolates of *P. cinnamomi* from soils and roots in Shanghai were predominantly A₁, showing little morphological and physiological characteristics and concluded that the fungus might have been a recent settler in that region. Hopefully, with more support and focused research, more interesting and significant information will come to light.

ACKNOWLEDGEMENTS:

Thanks are due to National Geographic Society and State of NY/UUP PDQWL Committee for financial support, to Professor Yu Yongnian for information regarding the students of Professor F.L. Tai, to Professor Lu Jiayun for assistance in locating several references, and to Drs. H.S. Chang and W.Y. Zhuang for reviewing the manuscript.

LITERATURE CITED

- Anonymous. 1951. A brief report on the disease status in Sichuan. Chinese Soc. Plant Pathol. Bull. 1-5: 19-21.
- Anonymous. 1960. Studies on potato blight disease (First Report). J. Northeast Agric. Coll. (4,5): 1-9.
- Anonymous. 1961. Studies on the occurrence pattern and control measures of cotton boll rot. 1961 Annu. Rept., Chinese Agric. Sci. Cotton Res. Inst.
- Anonymous. 1974a. Preliminary Investigation on *Phytophthora* disease of cotton seedling. Cotton (1): 29-32.
- Anonymous. 1974b. The isolation and reinoculation of cotton seedling *Phytophthora*. Zhejiang Agric. Sci. (2): 61-63.
- Anonymous. 1978. The identification of pathogen causing *Phytophthora* disease of cucumber. Microbiol. Newsl. 5 (1): 3-5.
- Anonymous. 1982. Preliminary study on *Phytophthora* disease of pepper. Xinjiang Agric. Sci. (6): 25-26.
- Anonymous. 1986. An investigation on the current national occurrence of cotton boll disease. Chinese Cotton (1): 42-44.
- Anonymous. 1990. The occurrence and control of pepper diseases in Changqi City. Xinjian Agric. Sci. (4): 168, 167.
- Cao, Y.Q., H. He, X.B. Zheng, and J.Y. Lu. 1993. Identification of *Phytophthora* species from *Boehmeria nivea*. In Reports and Abstracts, Inaugural Meeting, Mycol. Soc. China, Beijing, May, 1993, p. 57 (Abstr.).
- Chang, Y.N. 1990. The occurrence and control of pepper *Phytophthora* disease. Changjiang Veget. (6): 15.
- Chao, Y.B., Y.S. Lin and Y.M. Hu. 1981. Studies on the cucumber blight. J. Zhejiang Agric. Univ. 7: 49-67.

- Chen, F.R., Y.M. Zheng, J.B. He, and S.Y. Chen. 1989. An investigation on the distribution of various diseases of *Asparagus officinalis* L. in Fujian Province and their damages. Fujian Agric. Technol. (1): 26-27.
- Chen, H.F. 1986. Several common diseases of ramie and their control. Chinese Fiber (3): 25-27.
- Chen, R.T., X.D. Han, J.P. Zhou, and R.J. Jiang. 1963. A preliminary investigation into the epiphytology of tobacco black shank disease. Chinese Agric. Sci. (9): 7-12.
- Cheng, J.Z. 1980. A preliminary study of the occurrence and the control of cucumber die-back in the suburbs of Guangzhou. Acta Phytophylac. Sinica 7 (4): 209-214.
- Cheng, J.H. 1992. Studies on *Phytophthora* spp. infecting cucumbers in Guangzhou region and their pathogenicity Acta Phytophylac. Sinica 18 (1): 12-13.
- Cheng, J.Z., X.Y. Shu, and Y.M. Huang. 1989. The occurrence and experimental chemical control of citrus seedling *Phytophthora* disease in Guangzhou area. Chinese Citrus 18 (1): 37-38.
- Cheng, Y. and S.L. Chang. 1985. A method to determine the disease resistance against *Phytophthora infestans*. Chinese Veget. (1): 39-42.
- Cheng, Y., G.Y. Shen, and D.H. Duan. 1988. The main causes of *Phytophthora capsici* as one of *Capsicum* plant wilt in Beijing region. Acta Phytopathol. Sinica 18 (1): 7-12.
- Chou, Y. 1955. A summary of the investigation of vegetable diseases in summer, Xian. Chinese Soc. Plant Pathol. Bull. 11-12: 56-63.
- Chu, V.M. 1927. Plant pathogens seen in China. Agric. Assoc. China Bull. 54: 28-43.
- De Bary, A. 1876. Researches into the nature of the potato fungus, *Phytophthora infestans*. J. Roy Agric. Soc. Ser. 2, 12: 239-269.
- Deng, Y.S., W.G. Yu, C.B. Li, and Y.L. Lui. 1964. The isolation and inoculation experiments of cotton boll pathogen. Plant Prot. 2 (2): 84-86.
- Ding, H. Y. 1986. The factors governing the occurrence of cotton boll rot and its preventive control. Chinese Cotton (6): 43.
- Ding, X. T. 1987. The occurrence of serious rice *Phytophthora* disease in Jinyun region. Plant Prot. 13 (1): 51.
- Dou, T.D. and C.Y. Shen. 1993. Rapid detection of *Phytophthora megasperma* f. sp. *glycinea* by ELISA. In Reports and Abstracts, Inaugural Meeting. Mycol. Soc. China, Beijing, May 18-22, 1993, p. 288-289. (Abstr.)
- Fan, Q.Y. 1981. *Phytophthora* disease of rice seedlings. Agric. Sci. Bull. (2): 34.
- Fan, Y. and J. An. 1990. The inhibitory effect of membrane pore irrigation on pepper *Phytophthora* disease. Xinjiang Agric. Sci. (3): 122, 121.

- Gao, Q.W. and J.K. Huang. 1981. A study on cucurbit *Phytophthora* disease (dead vine) in Guangzhou region. Guangdong Agric. Sci. 6: 44-47.
- Ge, Q.X. 1991. A compilation of plant pests in Zhejiang (Plant Disease Section) Vol. 1. Shanghai Sci. Technol. Publ., China.
- Gregory, P.H. 1983. Some major epidemics caused by *Phytophthora*. In D.C. Erwin, S. Bartnicki-Garcia, and P.H. Tsao (eds.), *Phytophthora: Its Biology, Taxonomy, Ecology, and Pathology*. Am. Phytopathol. Soc., St. Paul, MN, pp. 271-278.
- Han, J.S. 1990. Diseases of Chinese Medicinal Plants. Jilin Sci. Technol. Publ., China.
- Han, J.S. 1992. A study on the physical control of plant diseases. In Abstracts of Papers. Inter-Strait Bilateral Plant Pathology Symposium, Beijing. August, 1992, pp. 169-70.
- He, H. 1992. Studies on biology of *Phytophthora boehmeriae* and disease cycle of cotton *Phytophthora* blight. M.S. Thesis, Dept. Plant Prot., Nanjing Agric. University, China.
- He, H., X.B. Zheng, Y.Q. Cao, and J.Y. Lu. 1993. A study on the role of oospores in disease cycle of cotton *Phytophthora* blight. Jiangsu J. Agric. Sci. 9 (2): 36-40.
- He, S.H. 1986. Epiphytology of tomato late blight and a study of the biological characters of the pathogen. Guizhou Agric. Sci. (3): 16-20.
- He, S.Q. 1988. Strawberry leather rot and its control. Gansu Agric. Technol. (7): 22-23.
- Ho, H.H. 1986. *Phytophthora melonis* and *P. sinensis* synonymous with *P. drechsleri*. Mycologia 78 (6): 907-912.
- Ho, H.H. 1990. Taiwan *Phytophthora*. Bot. Bull. Academia Sinica (Taipei) 31: 89-106.
- Ho, H.H., Y.N. Yu, W.Y. Zhuang, and Z.R. Liang. 1983a. Mating types of heterothallic species of *Phytophthora* in China I. Acta Mycol. Sinica 2: 187-191.
- Ho, H.H., W.Y. Zhuang, Z.R. Liang and Y.N. Yu. 1983b. *Phytophthora cinnamomi* on black locust (*Robinia pseudoacacia* in Jiangsu Province of China. Mycologia 75 (5): 881-886.
- Ho, H.H., Y.N. Yu, W.Y. Zhuang, and Z.R. Liang. 1983c. Mating types of heterothallic species of *Phytophthora* in China. In Reports and Abstracts, 50th Anniversary Bot. Soc. China, Taiyuan, August, 1983, pp. 298-299. (Abstr.)
- Ho, H.H., Z.R. Liang, W.Y. Zhuang, and Y.N. Yu. 1984a. *Phytophthora* spp. from rubber tree plantations in Yunnan Province of China. Mycopathologia 86: 121-124.
- Ho, H.H., J.Y. Lu, and L.Y. Gong. 1984b. Mating types of heterothallic species of *Phytophthora* in China II. Acta Mycol. Sinica 3 (1): 29-32.
- Ho, H.H., J.Y. Lu, and L.Y. Gong. 1984c. *Phytophthora* spp. associated with the decline of *Cedrus deodara* in Nanjing, China. Mycopathologia 85: 59-64.

- Ho, H.H., J.Y. Lu, and L.Y. Gong. 1984d. *Phytophthora drechsleri* causing blight of *Cucumis* species in China. *Mycologia* 76 (1): 115-121.
- Ho, H.H., Y.N. Yu, W.Y. Zhuang, Z.R. Liang, J.Y. Lu, and L.Y. Gong. 1984e. *Phytophthora* spp. in China. *Phytopathology* 74 (7): 883. (Abstr.)
- Hu, M. 1990. The Diseases and Insects Injurious to Strawberries and their Control. Tianze Publ., China.
- Hu, X.Z. and S.Z. Hu. 1988. The occurrence and control of rice *Phytophthora* disease in Xing Yang region. *Henan Agric. Sci.* (4): 18-19.
- Huang, H. 1962. A study on the formation pattern of disease centre of potato late blight disease. *Acta Phytopathol. Sinica* 1 (3): 255-268.
- Huang, H. and C.K. Lin. 1961. Basic theories in the control of potato late blight disease. *In* Plant Protection in China, Scientific Publ., Beijing, pp. 509-521.
- Huang, H. and D.Y. Xu. 1993. Determination of the viability of *Phytophthora* cultures stored in liquid nitrogen. *Acta Mycol. Sinica* 12 (1): 48-53.
- Huang, H., D.Y. Xu, and C.K. Lin. 1963. A favorable synthetic liquid medium for *Phytophthora infestans*. *Acta Phytopathol. Sinica* 6: 225-228.
- Huang, H., D.Y. Xu, and C.K. Lin. 1965. Further studies on synthetic media for *Phytophthora infestans*. *Acta Microbiol. Sinica* 11 (4): 463-469.
- Huang, H., D.Y. Xu, and C.P. Wang. 1980. The effect of organic acid and calcium on *Phytophthora infestans* (Mont.) De Bary. *Acta Phytopathol. Sinica* 10 (2): 95-102.
- Huang, H., S.Y. Wei, and X.Y. Meng. 1984. The occurrence of tomato late blight in Beijing and its forecasting. *Chinese Agric. Sci.* (4): 85-89.
- Huang, H., C.P. Wang, and D.Y. Xu. 1987. Further studies on the nutritional effects of organic acids on species of *Phytophthora*. *Acta Mycol. Sinica* 6 (3): 161-169.
- Huang, H., H. Chang, T. Xu, D. Xu, and S. Huo. 1981. The occurrence and alteration of physiological races of *Phytophthora infestans* in northern region of China. *Acta Phytopathol. Sinica* 11 (1): 45-49.
- Huang, J.K. and P.K. Qi. 1982. Studies on the *Phytophthora* species causing cucumber blight and its control in Guangzhou district. *J. South China Agric. Coll.* 3: 36-45.
- Huang, J.K. and P.K. Qi. 1984. A preliminary study on *Phytophthora* of yard-long bean (*Vigna sesquipedalis* (L.) Frw.). *Acta Phytopathol. Sinica* 14 (4): 193-199.
- Huang, L. 1943. Citrus diseases in Guangxi. *Guangxi Agric.* 4: 27-61.
- Huang, S.Y. and J.G. Wang. 1983. Studies on stem rot of black locust. *Sci. Silvia Sinica* 19 (4): 566-570.
- Ji, L., X.S. Zhang, and H.Y. Lai. 1958. Preliminary report on cotton boll rot. *Hubei Agric. Sci.* 1 (1): 37.

- Ji, S.Q. and B.D. Li. 1982. Identification of cotton seedling disease fungus. Chinese Agric. Sci. (1): 14-18.
- Ji, Z.F. and B.H. Fan. 1988. A study on cotton boll rot in Shanxi Province and its control. Plant Prot. 14 (5): 5-6.
- Jia, J.S. 1991. Preliminary study on Hami melon *Phytophthora* and its host range. J. August 1 Agric. Coll. 14 (3): 29-33.
- Jia, J.S. 1992. On the chilli pepper *Phytophthora* blight and its control in Xinjiang. Acta Phytopathol. Sinica 22 (3): 257-263.
- Jia, J.S. and B. Tang. 1989. Studies of cotton *Phytophthora* disease in Xinjiang and identification of the pathogen. Plant Prot. 15 (3): 16-18.
- Jiang, Y. and Q.Y. Shen. 1985. Effects of forsetyl-aluminum on late blight *Phytophthora* changes in infected host tissues and accumulation of rishitin. In Abstracts of Papers, 3rd Congress, Chinese Soc. Plant Pathol., Beijing, October 22-27, 1985. p. 19. (Abstr.)
- Li, B.D. and C.Y. Shen. 1993. Preliminary studies on using Hoaglands nutritional liquid culture method for fast identifying pathogenicity and sensitivity to fungicides of *Phytophthora capsici*. Acta Phytopathol. Sinica 23 (3): 243-244.
- Li, G.Y., X.L. Zhang, X. Lu, and X.T. Hu. 1993. Study on overwinter of the pathogen causing pepper *Phytophthora* blight. In Reports and Abstracts, Inaugural Meeting, Mycol. Soc. China, Beijing, May, 1993, pp. 123-124. (Abstr.)
- Li, G.Y., X.L. Zhang, X. Lu, and X.T. Hu. 1991. Preliminary research on host range and cultural property of *Phytophthora capsici*. Xinjiang Agric. Sci. (1): 20-23.
- Li, J.L. 1985. Taxonomic study of the genus *Phytophthora* de Bary in South China. Ph.D. Thesis. Inst. Microbiol., Academia Sinica, Beijing.
- Li, J.L. and Y.N. Yu. 1987. A taxonomic study of the genus *Phytophthora* in South China. In Abstracts of Papers, 2nd National Symposium on Fungi and Lichens. Wu Chang, November 10, 1986, p. 53.
- Li, J.S., H.J. Zhang, Z.M. Zhang, and Z.P. Zhao. 1992. Studies on the classification, damage, loss and control strategy for cotton boll rot in Shanxi Province. Acta Agric. Boreali-Sinica 7 (2): 87-91.
- Li, K.L. 1992. A study on potatoes on the specific of pathogenetic fungi of *Phytophthora infestans*. Acat. Sci. Natural. Univ. Intramonogolicae 23 (2): 229-234.
- Li, K.N. 1986. Studies on *Phytophthora drechsleri* Tucker from cucumber. M.S. Thesis. Dept. Plant Prot., Nanjing Agric. University, China.
- Li, M. 1951. A brief report on disease status in Shangtung in the first half of the year. Chinese Soc. Plant Pathol. 1-5: 15-18.

- Li, M.Y. 1981. The occurrence of vegetable diseases in Beijing region and problems of disease control. *Acta Phytophylac. Sinica* 7 (1): 8-9.
- Li, S., Z.T. Wang, D. Tang, and J.Y. Ma. 1982. A preliminary study on *Phytophthora* disease of melon in Xinjiang. *Xinjiang Agric. Sci.* (1): 20-21.
- Li, S., Z.T. Wang, D. Tang, J.Y. Ma, and L.Y. Gong. 1984. A study on the biological characters of Hami melon *Phytophthora*. *Xinjiang Agric. Sci.* (5): 13-14.
- Li, S., Z.T. Wang, D. Tang, and J.Y. Ma. 1986. Hami melon blight and its integrated control. *Acta Phytophylac. Sinica* 13 (1): 53-58.
- Li, Y.S. and Z.H. Liang. 1988. The epiphytology of pear black shank disease (pear crown wet rot disease) and a study of the pathogen. *Gansu Agric. Technol.* (3): 11-13.
- Li, Z.Q. 1991. Preliminary study on pepper *Phytophthora* disease in Hanzhou suburb. *Changjiang Veget.* (3): 20.
- Liang, P.Y. 1964. Identification of *Phytophthora* species causing cotton boll blight and castor bean blight in North China. *Acta Phytopathol. Sinica* 7 (1): 11-19.
- Liang, P.Y. and C.K. Lin. 1965. Starch utilization capability as a diagnostic character for species separation in *Phytophthora*. *Acta Phytopathol. Sinica* 8 (1): 57-60.
- Liang, Y.Q. 1992. Studies on the occurrence and damage of pepper *Phytophthora* disease in Shaanxi. *Acta Phytophylac. Sinica* 18 (1): 14-15.
- Liang, Z.H. 1991. Preliminary study on the crown rot of apple tree. *Shanxi Fruit Tree* (4): 26-27.
- Lin, C.K. 1961. The significance of observations on the primary foci in a plantation on the forecast and prevention of disease spread. *In The Collected Works of Dr. Chwan-Kwang Lin.* Hsintu Publ., New York, pp. 215-220.
- Lin, C.K. and H. Huang. 1962. Quantitative studies on the infection chains of potato late blight. *In the Collected Works of Chwan-Kwang Lin,* Hsintu Publ., New York, pp. 253-265.
- Lin, C.K. and P.Y. Liang. 1965. Studies on nitrogen, calcium, and organic acid requirements with reference to pH relations in the nutrition of some species of *Phytophthora*. *Acta Microbiol. Sinica* 11 (4): 470-479.
- Lin, C.K., H. Huang, K.T. Wang, S.H. Hwo, and T.P. Wang. 1955. Field observations on the epiphytology and experiments on the control of potato late blight. *Acta Phytopathol. Sinica* 1: 31-44.
- Lin, C.K., H. Huang, and S.H. Hwo. 1956. Studies on the forecasting and control of potato late blight. *Acta Agric. Univ. Pekinensis* 2: 79-85. (Abstr.)
- Lin, C.K., H. Huang, T.P. Wang, and S.H. Hwo. 1957. Observations on the formation of primary loci of late blight in a potato plantation. *Acta Phytopathol. Sinica* 3: 19-29.

- Lin. C.K., H. Huang, P.Y. Liang, and D.Y. Xu. 1981. Nutritional studies on various species of *Phytophthora*, with special reference to *P. infestans*. In The Collected Works of Dr. Chwan Kwang Lin. Hsintu Publ., New York, pp. 313-322.
- Lin. G.G. and G.Q. Zhou. 1981. Preliminary report on a study of the primary inoculum of late blight potato. Acta Phytopathol. Sinica 11 (2): 1-30.
- Ling. L. 1941. Host index of the parasitic fungi of Sichuan. Nanking J. 11: 117-142. (Plant Dis. Reprtr. Suppl. 173: 1-38. 1948).
- Liu. J.J. and G.Y. Yin. 1993. Studies on the root rot and yellow leaf disease of citrus in Jiangsu and Hubei Provinces. J. Nanjing Agric. Univ. 16 (1): 38-44.
- Liu. J.Y. 1988. Studies on the root rot and yellow leaf disease of citrus occurring in Jiangsu and Hubei provinces. M.S. Thesis, Dept. Plant Prot., Nanjing Agric. Univ., China.
- Liu. S.J. and M.H. Zhang. 1962. A study on the controlling factors of the resistance of potato tuber slices to late blight. Acta Phytopathol. Sinica 1 (3): 269-272.
- Liu. X.Z., C.Y. Shen, and S.X. Du. 1989a. A study on the variability of *Phytophthora cactorum*. In Abstracts of Papers, 60th Anniversary, Chinese Soc. Plant Pathol. (1929-1989), Beijing, Fall, 1989, p. 198 (Abstr.).
- Liu. X.Z., Y.C. Wang and C.Y. Shen. 1989b. A new agar medium for fungi. In Abstracts of Papers, 60th Anniversary, Chinese Soc. Plant Pathol. (1929-1989), Beijing, Fall, 1989, p. 272.
- Liu. Y.R., C.S. Xie, Z.F. Wang, and G.M. Zhang. 1987. Studies on the conditions governing sporangial formation and zoospore release in *Phytophthora parasitica* var. *nicotianae* from tobacco. Shandong Agric. Soc. (1): 28-30.
- Lu. J.Y. and L.Y. Gong. 1982. Studies on identification and biological characters of the causal organism of cucumber blight in Nanjing. J. Nanjing Agric. Coll. 3: 27-38.
- Lu. J.Y., L.Y. Gong, and H.H. Ho. 1984. Studies on biology and classification of *Phytophthora*. J. Nanjing Agric. Coll. 1 (1): 1-12.
- Lu. J.Y. and X.B. Zheng. 1988. Studies on mating type A₁ of *Phytophthora cinnamomi* Rands in China. Acta Phytopathol. Sinica 18 (3): 129-135.
- Ma. P. and C.Y. Shen. 1992. The overwintering of *Phytophthora boehmeriae*. In Abstracts of Papers, Inter-Strait Bilateral Plant Pathology Symposium. Beijing, August, 1992, pp. 37-38 (Abstr.). 21
- Ma. P. and C.Y. Shen. 1993. Identification of *Phytophthora* caused cotton boll and seedling blight in China. In Reports and Abstracts, Inaugural Meeting, Mycol. Soc. China, Beijing, May, 1993, p. 58 (Abstr.).

- Ma, X.Z., Z.Q. Yang, and J.Q. Xue. 1992. A study on the control of pepper *Phytophthora* disease. Ningxia Agric. For. Sci. Technol. (1): 22-25.
- Miyake, I. 1913. Studien uber Chinensiche Pilze. Bot. Mag. (Tokyo) 27: 37-54.
- Pang, L., H. Huang, and J.P. Zhou. 1985. Isolation and purification of toxin of *Phytophthora nicotianae* var. *parasitica* from tobacco. In 3rd Congress, Chinese Soc. Plant Pathol., Beijing, October 22-27, 1985, p. 20 (Abstr.).
- Pang, X.Y. 1991. Factors affecting pepper *Phytophthora* disease in Urumqi region and its control. Xinjiang Agric. Sci. (5): 213-215.
- Qi, P.K., J.K. Bai, and G.X. Zhu. 1966. A Monograph on the Fungal Diseases of Cultivated Plants in Jilin Province. Scientific Publ., Beijing, China.
- Qi, R.Z. and J.R. Yang. 1989. An investigation on the occurrence and damage of cotton boll disease. Shaanxi Agric. Technol. (3): 39.
- Reinking, O.A. 1921. Citrus diseases of the Philippines. Southern China, Indo-China and Siam. Philippine Agric. 9: 121-179.
- Ren, G.D., P.H. Ma, T.J. Wang, and J.Z. Zhang. 1990a. A study on the cause of pepper *Phytophthora* disease. Gansu Agric. Technol. (10): 33-35.
- Ren, G.D., P.H. Ma, T.J. Wang, and J.Z. Zhang. 1990b. A study on the occurrence and control of pepper *Phytophthora* disease in Gansu. Plant Prot. 16 (5): 16-17.
- Shen, C.Y. and L.Y. Guo. 1987. Identification of cotton boll *Phytophthora* species and a study of its biological characters. In Abstracts of Papers, 2nd National Symposium on Fungi and Lichen, Wu Chang, November 10, 1986, p. 82 (Abstr.).
- Shen, C.Y. and Y.C. Su. 1990. Discovery and preliminary studies of *Phytophthora megasperma* on soybean in China. In Papers and Abstracts of Papers, 3rd National Symposium on Fungi and Lichens, Beijing, November, 1990, p. 197 (Abstr.).
- Shen, C.Y. and Y.C. Su. 1991. Discovery and preliminary studies of *Phytophthora megasperma* on soybean in China. Acta Phytopathol. Sinica 21 (4): 208.
- Shen, C.Y., X.J. Wang, L. Tian, K.G. Shen, and T.Q. Li. 1990a. Identification and biological studies of *Phytophthora* causing blight of peppers in Gansu. J. Yunnan Agric. Univ. 5 (2): 72-77.
- Shen, C.Y., Y.G. Shi, L. Hong, and X.Z. Liu. 1990b. *Phytophthora* blight of black locust (*Robinia pseudoacacia*) in the vicinity of Beijing. Acta Agric. Univ. Pekinensis 16 (4): 415-419.
- Shen, S.C. and W.N. Siang. 1948. Studies on the aquatic Phycomycetes in China. Sci. Rep., National Tsing Hua Univ. Ser. B. 3: 179-206.
- Sparrow, F.K. 1960. Aquatic Phycomycetes, 2nd ed., Univ. Mich. Press, Ann Arbor, Mich.

- Su, Y.C. 1991. The discovery of *Phytophthora megasperma* f. sp. *glycinea* in China and a study on its biological characters. M.S. Thesis, Dept. of Plant Prot., Beijing Agric. University, China.
- Su, Y.C. and C.Y. Shen. 1993. Preliminary studies on antagonism of *Pythium oligandrum* to *Phytophthora megasperma*. In Reports and Abstracts, Inaugural Meeting, Mycol. Soc. China, Beijing, May 18-22, 1993. p. 150-151 (Abstr.).
- Sun, Q. and R.H. Zhou. 1992. Preliminary study on the tobacco production loss due to tobacco black shank. In Abstracts of Papers, Inter-Strait Bilateral Plant Pathology Symposium, Beijing, August, 1992, p. 111 (Abstr.).
- Tai, F.L. 1923. *Phytophthora* disease of taro. Agric. For. Quart. J. 1 (3): 1-8.
- Tai, F.L. 1927. A checklist of fungi in Jiangsu. Agric. Inform. 3 (6): 1-13.
- Tai, F.L. 1936. A list of fungi hitherto known from China. Sci. Rep., National Tsing Hua Univ., Ser. B. 2: 137-165.
- Tai, F.L. 1941. A preliminary list of economic plant disease of Yunnan. National Tsing Hua Univ. Agric. Res. Inst. Bull. 6: 1-36.
- Tai, F.L., W.N. Xiang and R.Y. Zheng. 1958. Index of Pathogens of Economic Plants in China. Scientific Publ., Beijing.
- Tai, F.L. 1979. A Cumulative Index of Fungi in China. Scientific Publ., Beijing.
- Tai, Z.Y. and C.C. Zhang. 1989. *Phytophthora cyperi* as the pathogen of *Cyperus malaccensis* blight in Guangxi. In Abstracts of Papers, 60th Anniversary, Chinese Soc. Plant Pathol. (1929-1989), Beijing, Fall, 1989, p. 8 (Abstr.).
- Tai, Z.Y. and C.C. Zhang. 1990. A new record of *Phytophthora cyperi* in China. Acta Mycol. Sinica 9 (3): 236-238.
- Tan, Y.J. and Q.F. Li. 1988. A study on the cause of cotton boll rot in Sichuan and the subsequent losses. Plant Prot. 14 (5): 2-4.
- Tang, D.Z., Y.B. Sun and S.Q. He. 1990a. Studies on *Phytophthora* species from pear and strawberry in Lanzhou. Acta Phytopathol. Sinica 20: 24.
- Tang, D.Z., Y.B. Sun, and S.Q. He. 1990b. Studies on *Phytophthora* species from honeydew and watermelon in Gansu province. Acta Univ. Agric. Boreali-occidentalis 18 (4): 74-79.
- Tang, D.Z., Y.B. Sun, and S.Q. He. 1991a. On overwintering oospores of *Phytophthora drechsleri* in the field. Acta Phytopathol. Sinica 21 (1): 59-62.
- Tang, D.Z., Y.B. Sun, S.Q. He, Y.Q. Li, K.C. Luo, and D.M. Li. 1991b. Studies on controlling blight of melon and watermelon by ridge cultivation. Acta Univ. Agric. Boreali-occidentalis 19 (3): 105-107.
- Tang, D.Z., Y.B. Sun and S.Q. He. 1992a. Infection process of *Phytophthora drechsleri* in melon leaf. Acta Phytopathol. Sinica 22 (2): 116.

- Tang, D.Z., Y.B. Sun, and S.Q. He. 1992b. Infection process of *Phytophthora drechsleri* in melon leaf. Acta Univ. Agric. Boreali-occidentalis 1: 89-91.
- Tang, D.Z., Y.B. Sun, S.Q. He and Y.Q. Li. 1992c. Study on infection cycle, epidemic factors and the control of *Phytophthora* blight of honey dew. Acta Phytophylac. Sinica 19 (3): 272-275.
- Tang, H.M. 1987. Potato cultivars. Potato Mag. 1 (1): 55-60.
- Tang, J.Q. 1990. A serious outbreak of cotton seedling *Phytophthora* disease in Panze region in 1989. Plant Prot. 16 (4): 46.
- Tsao, I.C., F. Yeh, S.C. Chong, S.H. Hsu, and L.Y. Lu. 1964. On the occurrence and control of the tuber rot caused by potato late blight. Acta Phytophylac. Sinica 3 (4): 420-421.
- Tsou, C.L. 1922. A list of plant pathogens in Nanking. The Science 7 (2): 184-195.
- Wang, J.S. and J.Y. Lu. 1978. *Phytophthora* leaf blight of rice seedling - a new disease of rice. Acta Microbiol. Sinica 18 (2): 95-101.
- Wang, J.S. and M.S. Lin. 1979. A study on the biology of zoospores of *Phytophthora fragariae* var. *oryzobladis*. Acta Phytopathol. Sinica 9 (1): 55-60.
- Wang, M.Q. 1950. An index of plant diseases in Henan. N. China Agric. Sci. Res. Inst. Spec. Bull. 2: 1-23.
- Wang, P. and J.Y. Lu. 1988. Homothallic and heterothallic behavior of *Phytophthora drechsleri* Tucker. Acta Mycol. Sinica 7 (2): 102-111.
- Wang, Y.H. and S.B. Yang. 1980. The isolation and identification of the causal agent of cucumber blight in Shanghai area. Plant Prot. 6: 2-4.
- Wang, Y.H. and S.B. Yang. 1982. The identification of pepper *Phytophthora* in Shanghai area. Shanghai Agric. Technol. (1): 20-21.
- Wang, Z.F., Y.R. Liu, C.S. Xie, G.M. Zhang, S.H. Xing, Z. Giang, and R.T. Chen. 1985. A preliminary study on identifying races of black shank pathogen (*Phytophthora parasitica* var. *nicotianae*) in Shandong Province. Acta Phytopathol. Sinica 12: 51-55.
- Wang, Z.F., J.Z. Lin and D.L. Ma. 1989. Physiological and biochemical studies of *Phytophthora parasitica* var. *nicotianae*, Chinese Tobacco (2): 1-4.
- Wang, Z.T. 1988. The growth rate and pathogenicity of four species of *Phytophthora*. Xinjiang Agric. Sci. (2): 27-28.
- Wang, Z.T., J.Y. Ma, S.E. Li and D. Tang. 1985. Preliminary identification of physiological races of *Phytophthora parasitica* var. *nicotianae* in Shantung Province. Acta Phytophylac. Sinica 12 (1): 51-55.
- Wang, Z.T., J.Y. Ma, S.E. Li and D. Tang. 1986. The occurrence and control of watermelon *Phytophthora* disease. Plant Prot. 12 (3): 37.
- Wang, Z.T., L.Z. Zhao, Z.C. Shi, and Y. Mei. 1990a. A study on seed-borne pepper *Phytophthora* disease. Xinjiang Agric. Sci. (1): 24.

- Wang, Z.T., Z.C. Shi, L.Z. Zhao and Y. Mei. 1990b. The identification of *Phytophthora* species from pepper in Hami region and partial determination of its biology. Xinjiang Agric. Sci. (2): 69-71.
- Wang, Z.T., Y.Y. Cui, H. Yang, and J. He. 1993. Identification and biological characteristics of *Phytophthora* sp. from pepper in Xinjiang. Xinjiang Agric. Sci. (4): 164-167.
- Wei, C.T. 1939. Storage diseases of sweet oranges in Sichuan. Nanking J. 9: 239-268.
- Wei, C.T. and S.W. Hwang. 1940. A checklist of fungi deposited in the mycological herbarium of the University of Nanking. Nanking J. 9: 329-372.
- Wei, C.T. and P.C. Chao. 1944. Diseases of tomato in the vicinity of Chengtu. Chinese J. Sci. Agric. 1: 288-294.
- Wei, J.C. 1979. Handbook on Fungal Identification. Sci. Technol. Publ., Shanghai, China.
- Wong, Z.X. and S.P. Wu. 1957. A report on the investigation of tomato late blight disease in the greenhouses of Beijing suburb. Plant Dis. Knowl. (3): 38-39.
- Wong, Z.X. and X.X. Jiang. 1980. The identification of *Phytophthora* blight of cucumber. 1979 Annu. Rept., Inst. Veget. Res., Chinese Acad. Agric. Sci. 167-174.
- Wong, Z.X. and X.X. Jiang. 1982. Integrated measure of control of cucumber blight caused by *Phytophthora melonis*. Chinese Agric. Sci. 3: 67-72.
- Wu, L.Z., Z.Y. Zhu, S.J. Lu, and S.J. Wang. 1992. The annual fluctuations and survival of *Phytophthora capsici* in soil. In Abstracts of Papers, Inter-Strait Bilateral Plant Pathology Symposium, Beijing, August, 1992, p. 110 (Abstr.).
- Wu, X.Z., Q.J. Li, and F.R. Wang. 1993. Effects of exudates of cotton boll of different age on *Phytophthora boehmeriae* and *Colletotrichum gossypii*. Acta Phytopathol. Sinica 23 (3): 245-252.
- Xiang, W.N. 1983. In deep memory of my mentor Professor F.L. Tai. Acta Mycol. Sinica 2 (2): 73.
- Xiao, C.L., Y.Y. Xiao and S.M. Zeng. 1992. Preliminary studies on the sporangia infection probability and patterns of lesion appearance of tomato late blight (*Phytophthora infestans*). Acta Phytopathol. Sinica 22(1): 41-46.
- Xiao, Y.X. and H. Huang. 1985. Potato tuber tissues -- a study on the relationship between the reaction types of virulent strains of *Phytophthora infestans* and the accumulation of rishitin. In Abstracts of Papers, 3rd Congress, Chinese Soc. Plant Pathol., Beijing, October 22-27, 1985, p. 18 (Abstr.).
- Xiao, Y.X. and H. Huang. 1986. Evaluation of the role of rishitin in resistance response of potato to *Phytophthora infestans*. Acta Phytopathol. Sinica 16 (4): 239-243.
- Xie, M.S. 1986. Integrated control of pests and diseases of watermelons and melons in Wujiaqu. Xinjiang Agric. Sci. (3): 19-20.

- Xu, D.Y. and H. Huang. 1987. Storage of *Phytophthora* cultures in liquid nitrogen ultra low temperature. *Acta Mycol. Sinica* 6 (2): 103-109.
- Xu, S.C. 1988. Preliminary observations and experimental control of citrus seedling *Phytophthora* disease. *Chinese Citrus* 17 (2): 24.
- Xu, J.Y., J.Y. Lu and Z.D. Fang. 1990a. Studies on *Phytophthora* species from black locust (*Robinia pseudoacacia* L.) in China. *J. Nanjing Agric. Univ.* 13 (4): 17-23.
- Xu, J.Y., J.Y. Lu and Z.D. Fang. 1990b. Studies on species of *Phytophthora* causing blight of *Cedrus deodara* in China. *J. Nanjing Agric. Univ.* 13 (4): 24-29.
- Xu, J.Y., J.Y. Lu and Z.D. Fang. 1991. Studies on biological behaviors in sexual reproduction of *Phytophthora* species. *J. Jiangsu Agric. Coll.* 12 (1): 65-71.
- Xu, J.Y., J.Y. Lu and Z.D. Fang. 1993. Polyacrylamide gel plate electrophoresis of soluble proteins and esterases from mycelia of six species of *Phytophthora*. *Acta Mycol. Sinica* 12 (1): 54-64.
- Xu, L. 1989. The status and problems of the occurrence of rice *Phytophthora* disease in Jiangxi. In Abstracts of Papers, 60th Anniversary, Chinese Soc. Plant Pathol. (1929-1989), Beijing, Fall, 1989, p. 5 (Abstr.).
- Yang, S.F. and L.Q. Zhang. 1989. Preliminary report on the integrated control of pepper *Phytophthora* disease in Tianshui City. *Gansu Agric. Technol.* (11): 32-34.
- Yang, Y.J. and C.Y. Shen. 1992. Effects of animal and plant hormones on the growth and sexual reproduction of *Phytophthora capsici*. In Abstracts of Papers, Inter-Strait Bilateral Plant Pathology Symposium, Beijing, August, 1992, p. 107 (Abstr.).
- Yang, Y.J. 1992. Studies on physiology of sexual reproduction in *Phytophthora capsici* Leon. M.S. Thesis, Dept. Plant Prot., Beijing Agric. University, China.
- Yang, X.F. and S.Q. Liu. 1985. Artificial inoculation of *Hevea brasiliensis* by *Phytophthora colocasiae*. *Yunnan Trop. Crop Tech.* (2): 34-35.
- Yang, Z., Z.Y. Zhu and X.M. Huang. 1989. The discovery of *Phytophthora vignae* in East China region. *J. Jiangsu Agric. Coll.* 10 (1): 58.
- Yang, Z.X. and D.Y. Liu. 1988. The symptoms and control of apple *Phytophthora* disease. *Decidu. Fruit Trees* (2): 41-42.
- Yi, Y.Q. and Q.H. Feng. 1986. An investigation of the occurrence of *Phytophthora* disease on early rice in Wanan region. *Jiangxi Agric. Technol.* (8): 11.
- You, B. 1988. Study on the pathogen of citrus collar rot in Hunan. *Acta Phytopathol. Sinica* 18 (1): 72.
- Yu, M.X. 1939. A report on the investigation of tobacco diseases of Chengdu plain. *Nung Ling Sin Pao* 16 (32-36): 6-10.

- Yu, M.X., X. Dai and H.L. Shu. 1955. A preliminary summary of the work on the control of tobacco blank shank disease. Chinese Soc. Plant Pathol. Bull. 11-12: 46-55.
- Yu, T.F. 1940. A list of important crop diseases occurring in Kiangsu Province (1934-1937). Lingnan Sci. J. 19: 67-78.
- Yu, Y.N. 1993. The collected mycological works of Yu Yongnian. Chemical Industry Publ., Beijing.
- Yu, Y.N. and W.Y. Zhuang. 1982. *Phytophthora sinensis*, a new species causing blight on *Cucumis sativa*. Mycotaxon 14: 181-182.
- Yu, N.Y., W.Y. Zhuang and J.L. Li. 1986a. Notes on Chinese *Phytophthora* from citrus. Acta Mycol. Sinica, Suppl. 1: 1-39.
- Yu, Y.N., J.L. Li and X.F. Yang. 1986b. Studies on *Phytophthora* species from rubber tree (*Hevea brasiliensis*) in China. Acta Mycol. Sinica 5 (4): 193-207.
- Yu, Y.N. and X.J. Liu. 1990. The order Peronosporales in China. In Papers and Abstracts of Papers. 3rd National Symposium on Fungi and Lichens. Beijing, November, 1990. pp. 108-109 (Abstr.).
- Zentmyer, G.A. 1983. The world of *Phytophthora*. In D.C. Erwin, S. Bartnicki-Garcia and P.H. Tsao (eds.) *Phytophthora: Its Biology, Taxonomy, Ecology, and Pathology*. Am. Phytopathol. Soc., St. Paul, MN. pp. 254-255.
- Zhang, C.C. and Z.Y. Tai. 1992. On *Cyperus malaccensis* blight. Acta Phytopathol. Sinica 22 (2): 97-102.
- Zhang, J.Q. and M.X. Ma. 1980. On the occurrence and control of *Phytophthora* boll rot of cotton on Shanghai. Acta Phytophylac. Sinica 7 (4): 221-226.
- Zhang, J.Q., M.X. Ma and M.H. Xu. 1981. Observations on the survival of the pathogen of cotton *Phytophthora* boll disease. Shanghai Agric. Technol. (4): 18.
- Zhang, J.Q. and D.Y. Zhang. 1985. Observations on the occurrence pattern of cotton boll disease, 1976-1984. In Abstracts of Papers. 3rd Congress. Chinese Soc. Plant Pathol., Beijing, October 22-27, 1985, p. 5 (Abstr.).
- Zhang, K.M., Y.D. Li and F.C. Zheng. 1993. Identification and mating type of *Phytophthora* species on citrus trees in Hainan and Zhanjiang. Acta Phytopathol. Sinica 23 (2): 179-185.
- Zhang, K.M., F.C. Zheng, Y.D. Li, P.J. Ann and W.H. Ko. 1994. Isolates of *Phytophthora colocasiae* from Hainan Island in China: evidence suggesting an Asian origin of this species. Mycologia 86: 108-112.
- Zhang, L. 1964. The position effect of leaves on the resistance of potato to late blight. Plant Prot. 2 (1): 27.
- Zhang, P.Z. 1983. The occurrence pattern and control of major disease of cotton boll. Chinese Cotton (4): 43-44.

- Zhang, P.Z. 1985. Studies on cotton boll *Phytophthora* disease and its control. In Abstracts of Papers, 3rd Congress, Chinese Soc. Plant Pathol., Beijing, October 22-27, 1985, p. 45 (Abstr.).
- Zhang, P.X., Y.S. Zheng and Y.H. Feng. 1989. Agar plate tests on the efficacy of chemical control of *Phytophthora capsici*. Gansu Agric. Technol. (12): 33-34.
- Zhang, P.R., H.S. Chen, and H.F. Gu. 1992. On the control effects of 14 fungicides against pepper *Phytophthora* rot fungus. Plant Prot. 18 (4): 25-26.
- Zhang, X.B. 1983. A catalog of diseases of economic plants in the vicinity of Fuzhou II. J. Fujian Agric. Coll. (1): 77-86.
- Zhang, X.Z., K.M. Liu, S.Q. Zhang, and H.C. Jia. 1963. The biological characters of cotton boll *Phytophthora* and a preliminary report on the study of infection of cotton at different growth stages. J. Hubei Agric. Coll. 2 (3): 37-46.
- Zhang, Z.C. 1916. A table of the predominant plant diseases occurring in the vicinity of Beijing. Dept. Agric. Econ., Central Agric. Exp. Sta. 3rd Stage Rept. Appendix: 1-17.
- Zhao, Q.R. 1962. A study on the primary infection of potato late blight. Acta Phytopythol. Sinica 1 (4): 441.
- Zhao, Y.F., L.J. Wu, W.J. Yang and X.H. Li. 1993. Studies on the pathogen of ginseng *Phytophthora* blight. Acta Phytopythol. Sinica 23 (3): 260.
- Zheng, G.B. 1980. The occurrence and control of tomato late blight. Agric. Technol. Newsl. (2): 30.
- Zheng, X.B. and J.Y. Lu. 1988. Euonymus root rot caused by *Phytophthora* spp. Acta Phytopythol. Sinica 18 (4): 203-207.
- Zheng, X.B. and J.Y. Lu. 1989a. Studies on characteristics of *Phytophthora* and identification of two varieties of *P. nicotianae*. J. Nanjing Agric. Univ. 12 (2): 44-52.
- Zheng, X.B. and J.Y. Lu. 1989b. Studies on *Phytophthora* species in Fujian, Zhejiang, Jiangsu provinces and Shanghai, China. J. Nanjing Agric. Univ. 13: 61-64.
- Zheng, X.B. and J.Y. Lu. 1990a. Distribution of *Phytophthora* species and mating type in East and Northeast China. J. Nanjing Agric. Univ. 13: 61-64.
- Zheng, X.B. and J.Y. Lu. 1990b. A preliminary study on the stimulation of sporangial production in *Phytophthora* by soil leachate. J. Nanjing Agric. Univ. 13: 125.
- Zheng, X.B. and J.Y. Lu. 1990c. *Phytophthora* species and the diseases in Liaoning and Heilongjiang provinces. Acta Phytopythol. Sinica 20 (4): 209-310.
- Zheng, X.B. and J.Y. Lu. 1991. Studies on the procedure to establish single zoospore asexual strains of *Phytophthora drechsleri*. J. Nanjing Agric. Univ. 14 (4): 135.

- Zheng, X.B. and J.Y. Lu. 1992a. Genetics of *Phytophthora drechsleri* I. Variation of biological characters in S₁ progeny. Acta Mycol. Sinica 11 (1): 63-71.
- Zheng, X.B. and J.Y. Lu. 1992b. Genetics of *Phytophthora drechsleri* II. The inheritance of mating types. Acta Mycol. Sinica 11 (2): 134-141.
- Zheng, X.B., J.Y. Lu and Z.D. Fang. 1991. On the germination of oospores of *Phytophthora drechsleri*. Acta Phytopathol. Sinica 21 (4): 251-256.
- Zheng, X.B., J.Y. Lu and Z.D. Fang. 1992a. Effects of oospore treatments with KMnO₄ or H₂O₂ on biological characters of single-oospore cultures of *Phytophthora drechsleri*. Acta Phytopathol. Sinica 22 (2): 157-161.
- Zheng, X.B., J.Y. Lu and Z.D. Fang. 1992b. The selection of mating pairs of *Phytophthora drechsleri* parents with double-marker. J. Nanjing Agric. Univ. 15 (1): 47-53.
- Zheng, X.B., J.Y. Lu and Z.D. Fang. 1992c. The behavior of sexual reproduction in the crosses of intraspecific isolates of *Phytophthora drechsleri*. J. Nanjing Agric. Univ. 15 (3): 35-40.
- Zheng, X.B., J.Y. Lu, H. He, T.L. Wang and H.Y. Wang. 1992d. Oospores of *Phytophthora boehmeriae* overwintered in soil as an infection source of cotton boll rot disease. Acta Phytophylac. Sinica 19 (3): 251-256.
- Zheng, X.B., T.L. Wang and J.Y. Lu. 1993. Induction of oospore germination of *Phytophthora boehmeriae*. J. Nanjing Agric. Univ. 16 (1): 50-54.
- Zheng, Y.M. 1989. Studies on *Phytophthora* species from citrus in Sichuan and their biological characters. In Abstracts of Papers, 60th Anniversary (1929-1989), Chinese Soc. Plant Pathol. Beijing, Fall, 1989, p. 6 (Abstr.).
- Zhou, G.Q. and G.G. Lin. 1965. Studies on the pathogenicity and morphological changes of *Phytophthora infestans* in water and soil. Acta Phytopathol. Sinica 8: 11-14.
- Zhou, J.P. and B.H. Wang. 1984. Field observation on the epiphytology of tobacco black shank (*Phytophthora parasitica* f. *nicotianae* (Breda de Haan) Tucker). Acta Phytophylac. Sinica 14: 39-45.
- Zhou, J.P., H. Huang and L. Pan. 1985. Preliminary studies on the selection of mutated cells resistant to tobacco black shank disease. In Abstracts of Papers, 3rd Congress, Chinese Soc. Plant Pathol., Beijing, October 22-27, 1985, p. 82 (Abstr.).
- Zhou, Q.M., L.Y. Li and J.H. Yang. 1984. An investigation on *Phytophthora* disease of pepper. Chinese Veget. (1): 40-43.
- Zhou, X.G., Z.Y. Zhu, C.P. Lu, S.J. Wang and W.H. Ko. 1992. *Phytophthora cinnamomi* in Shanghai and its possible origin. Mycopathologia 120: 29-32.
- Zhou, Z.H. 1984. A summary report on the cotyledon disease, *Phytophthora* disease and anthracnose of ramie. Chinese Fiber (1): 34-38.

- Zhou, Z.H. 1986. Integrated control of ramie *Phytophthora* disease in the field. Chinese Fiber (1): 36-37.
- Zhu, W.S. and H. Chen. 1990. Primary study on the damping-off disease of citrus seedling. Acta Phytopathol. Sinica 17: 354, 368.
- Zhu, W.S., X.Y. Lan, H. Chen, Y.C. Su and C.Y. Shen. 1993. On the foot rot of citrus. Acta Phytopathol. Sinica 23 (2): 151-155.
- Zhu, X.C., Z.Y. Guo and B.A. Liu. 1984. A preliminary report on the study of physiological races in *Phytophthora parasitica* var. *nicotianae*. Chinese Tobacco (1): 4-7.
- Zhu, X.C., Z.Y. Guo and B.A. Liu. 1987. Identification of physiological races of the black shank pathogen (*Phytophthora parasitica* var. *nicotianae*) in Shandong Province. Acta Phytopathol. Sinica 17 (2): 90-95.
- Zhu, X.G. 1982. An investigation on cotton boll rot disease in Ningbo region. Acta Phytophylac. Sinica (5): 8-9.
- Zhu, Z.L., Y.W. Hu and D.Q. Yang. 1989. Polyacrylamide gel plate electrophoresis of proteins from mycelia of citrus foot rot pathogens. Sichuan Fruit Tree Sci. Technol. 17 (2): 26-28.
- Zhu, Z.L., D.L. Deng and Q.Y. Lan. 1990. A study on the resistance of citrus stock to citrus foot rot pathogen (*Phytophthora parasitica*). Sichuan Fruit Tree Sci. Technol. 18 (2): 29-30.
- Zhu, Z.Y., S.J. Wang, L.Z. Wu, X.G. Zhou and J.P. Lu. 1990. Studies on *Phytophthora* species in Shanghai region. In Papers and Abstracts of Papers, 3rd National Symposium on Fungi and Lichens, Beijing, November, 1990. p. 196 (Abstr.).
- Zhuang, W.Y. 1981. Taxonomic studies on the genus *Phytophthora* in China. M.S. Thesis, Inst. Microbiol., Academia Sinica, Beijing.

GLIOCLADIOPSIS IRREGULARIS SP. NOV. AND NOTES ON CYLINDROCLADIUM SPATHIPHYLLI

P.W. Crous¹ and A. Peerally²

¹Department of Plant Pathology, University of Stellenbosch, 7600
Stellenbosch, South Africa; ²Faculty of Science, University of Mauritius,
Reduit, Mauritius

ABSTRACT

A new species of *Gliocladiopsis* with penicillate and subverticillate conidiophores and irregularly curved 1-septate conidia is described from soil as *G. irregularis*. The variation present in the vesicle morphology of *Cylindrocladium spathiphylli* is discussed, and a previously unknown microconidial state reported.

INTRODUCTION

The genus *Gliocladiopsis* Saksena (1954) was erected for species with hyaline, cylindrical conidia borne in slimy masses on whorls of phialides on penicillate conidiophores. This genus is presently monotypic, and the type species, *G. sagariensis* Saksena was shown to be synonymous with the earlier described *Cylindrocarpon tenue* Bugn. (Agnihotrudu, 1959). Barron (1968), however, regarded the genus as a later synonym of *Cylindrocladium* Morgan. Crous & Wingfield (1993) stated that *Gliocladiopsis* should be retained for species with penicillate conidiophores lacking stipe extensions and terminal vesicles as commonly found in *Cylindrocladium* and *Cylindrocladiella* Boesewinkel. Based on the converging branching pattern of the penicillate conidiophores, the genus *Cylindrocarpon* was also found unsuitable. *C. tenue* was subsequently placed in *Gliocladiopsis* as *G. tenuis* (Bugn.) Crous & M.J. Wingf., with *G. sagariensis* as synonym. Watanabe (1994) stated, however, that because several species of *Cylindrocladium* and *Cylindrocladiella* lose their ability to produce stipe extensions in culture, this is not a stable criterium to separate

these genera. *Cylindrocarpon tenue* was subsequently transferred to *Cylindrocladium*. Other studies on *Cylindrocladium* and *Cylindrocladiella* (Crous & Wingfield, 1993; 1994) showed that all species in these two genera do in fact produce stipe extensions on penicillate conidiophores.

Watanabe (1994) also regarded *Cylindrocladium intermedium* Matsushima to be a synonym of *Gliocladiopsis tenuis*. However, the latter species was described with conidia being $20\text{--}30 \times 1.6\text{--}2.8 \mu\text{m}$ (Matsushima, 1971), which is larger than any conidial measurement ever published for *G. tenuis* (Crous & Wingfield, 1993), or those obtained in the present study (Table 1). Although *C. intermedium* is probably better accommodated in *Gliocladiopsis* than *Cylindrocladium*, such a decision will have to be based on a re-examination of the type specimen.

As part of an ongoing study baiting soil samples for isolates of *Cylindrocladium* spp. (Crous *et al.*, 1994), several strains of *Gliocladiopsis tenuis* were also obtained (Table 1). One such a collection proved to be distinct from *G. tenuis*. Although similar in general morphology, this species is unique in having smaller conidia and phialides. Furthermore, conidia are variously curved, and frequently slightly swollen in the apical cell. Because this collection proved distinct from the type strain of *G. tenuis* and all other strains studied, it is described as new below:

***Gliocladiopsis irregularis* Crous & Peerally sp. nov.**

Fig. 1.

Vesiculae et stipites absentiae. Conidiophorae penicillatae, rami primarii rare 1-septati, $(15\text{--})17\text{--}(25) \times (3\text{--})3.5 \mu\text{m}$, rami secundarii non septati, $(15\text{--})18\text{--}(20) \times 2.5\text{--}(3) \mu\text{m}$, rami tertiarum non septati, $(9\text{--})11\text{--}(14) \times 2\text{--}(2.5) \mu\text{m}$; phialides doliiformes ad reniformes ad cymbiformes, $(10\text{--})13\text{--}(16) \times (2\text{--})3 \mu\text{m}$, in verticillis terminalibus, ad sex in quoque ramulo; collarettae praesentes. Conidiophorae subverticillatae paucae, plerumque in mycelium aerium; phialides cylindricae, $(20\text{--})25\text{--}(35) \times 2.5\text{--}(3) \mu\text{m}$; collarettae praesentes. Conidia 1-septata, hyalina, laevigata, cylindrica, recta ad varie curvata, apice obtuso, base subtruncata, cellula apicali saepe parum tumida, $(11\text{--})13\text{--}(14) \times 2.5\text{--}(3) \mu\text{m}$. Teleomorphus ignotus.

HOLOTYPE. INDONESIA. Northern Sumatra, soil, 22 Nov. 1993, A.C. Alfenas, PREM 51870, ex type culture STE-U 718).

Table 1 Morphological features and temperature requirements for growth of *Gliocladiopsis* spp. studied.

Species	Accession No	Conidial dimensions (µm) ^a	Cardinal temps. for growth (°C) ^b				Substrate	Origin	Collector
			length x width	Conidial septation	min	opt	max		
<i>G. tenuis</i>	IMI 300 597	(15-)18(-22) x 1.5(-2)		1	<10	30	>35	India	IMI
	CBS 199.55	(12-)19.5(-23) x (1.5-)2		1	<10	30	>35	India	S.B. Saksena
	CBS 978.73	(14-)17(-21) x 1.5(-2)		1	<10	25	>35	Brazil	C.S. Hodges
	STE-U 636	(16-)22(-26) x 1.5(-2.5)		1(-3)	<10	30	>35	USA	N.E. El-Gholl
								<i>Chamaedorea elegans</i>	
	STE-U 706	(15-)17(-19) x (1.5-)2(-2.5)		1	<10	30	>35	Hong Kong	P.W. Crous
	STE-U 707	(15-)19(-21) x (1.5-)2		1	<10	30	>35	Thailand	P.W. Crous
	STE-U 714	(14-)17(-22) x 2(-2.5)		1	<10	25	>35	Indonesia	P.W. Crous
<i>G. irregularis</i>	STE-U 715	(13-)17(-20) x (1.5-)2(-2.5)		1	<10	25	>35	Indonesia	P.W. Crous
	STE-U 716	(15-)17(-19) x (1.5-)2(-2.5)		1	<10	30	>35	Indonesia	P.W. Crous
	STE-U 717	(15-)19(-21) x (1.5-)2		1	<10	30	>35	Indonesia	P.W. Crous
	STE-U 731	(12-)17(-20) x (1.5-)2(-2.5)		1	<10	25	>35	Columbia	P.W. Crous
	STE-U 718	(11-)13(-14) x 2.5(-3)		1	<15	25	>35	Indonesia	P.W. Crous

^a Averages are representative of 30 observations on CLA, with extremes listed in parentheses.^b Radial growth assessed on MEA after 7d in the dark at 5-35°C in 5° intervals. Three plates were used per isolate at each temperature, and the experiment repeated.

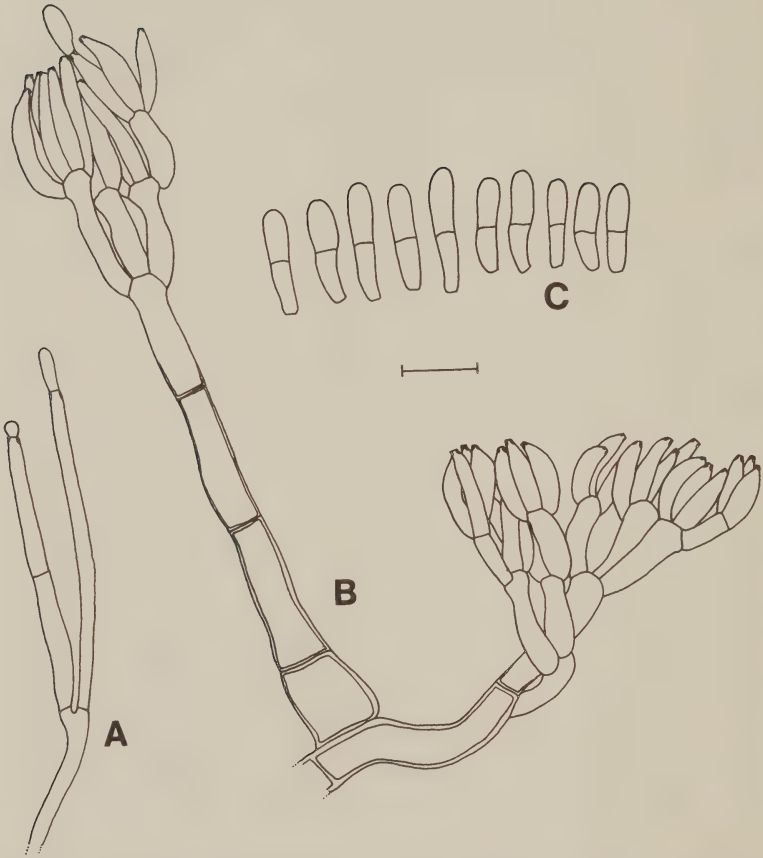


Fig. 1A-C. *Gliocladiopsis irregularis*. A. Subverticillate conidiophore. B. Penicillate conidiophore. C. Irregular 1-septate conidia (bar = 10 μm).

Colonies on 2 % malt extract agar (MEA) (Biolab) plates incubated at 25°C in the dark for 7 d were cinnamon in colour (15th, Rayner, 1970). Chamydospores formed in sparse numbers, and frequently formed a stroma on which several conidiophores were situated. Cardinal temperature requirements for growth in 5° increments were: below 15°C (minimum), 25°C (optimum), and above 35°C (maximum).

All morphological observations were made on carnation-leaf agar (CLA) plates incubated for 7 d at 25°C in the dark. Vesicles and stipes absent. *Penicillate conidiophores*, primary branches rarely 1-septate, (15-)17(-25) x (3-)3.5 µm, secondary branches non-septate, (15-)18(-20) x 2.5(-3) µm, tertiary branches non-septate, (9-)11(-14) x 2(-2.5) µm; phialides doliform to reniform to cymbiform, (10-)13(-16) x (2-)3 µm, arranged in terminal whorls of up to six per branch; collarettes present. *Subverticillate conidiophores* sparse in number, mostly present in aerial mycelium; phialides cylindrical, (20-)25(-35) x 2.5(-3) µm; collarettes present. *Conidia* 1-septate, hyaline, smooth, cylindrical, straight to variously curved, apex obtuse, base subtruncate, apical cell frequently slightly swollen, (11-)13(-14) x 2.5(-3) µm. *Teleomorph* unknown.

SUBSTRATE. Soil.

KNOWN DISTRIBUTION. Indonesia (northern Sumatra), known only from type collection.

One strain (STE-U 636) isolated from *Chamaedorea elegans* in the USA has conidia which are (16-)22(-26) x 1.5(-2) µm and 1(-3)-septate. Although these conidia have more septa and are slightly longer than those of the other strains sporulating on CLA, we are hesitant to describe this as a new taxon, and are of the opinion that additional collections or molecular techniques would be required to support such a decision. Although conidial dimensions and septation is a good indication of species limits in *Cylindrocladium*, some strains of species such as *C. ovatum* El-Gholl *et al.* and *C. spathiphylli* Schoutties *et al.* have been collected that form only one conidial septum, whereas others, as in the case of *Gliocladiopsis* strain STE-U 636, can form up to three.

All teleomorphs with *Cylindrocladium* anamorphs are presently placed in *Calonectria* De Not., while those with *Cylindrocladiella* anamorphs are accommodated in *Nectria* Fr. subsection *Dialonectria* Sacc. Although all

Gliocladiopsis strains (Table 1) were mated in all possible combinations using the methods described by Crous *et al.* (1993a), no teleomorph was obtained. This suggests, therefore, that a molecular approach would probably be required to elucidate relatedness among the genera *Gliocladiopsis*, *Cylindrocladium* and *Cylindrocladiella*.

Cylindrocladium spathiphylli

Fig. 2.

In 1972 the second author collected a *Cylindrocladium* species from *Camellia sinensis* L. in Mauritius, which was subsequently lodged at IMI. In an examination of this specimen (Crous *et al.*, 1991), globose vesicles and 3-septate conidia were observed. Several years after this isolate was collected, Schoutties *et al.* (1982) described a species with 1-septate conidia and similar vesicle morphology from *Spathiphyllum* as *C. spathiphylli*. Uchida & Aragaki (1992) reported, however, that this species could have 1-3-septate conidia with sphaeropedunculate, ellipsoid or spathulate vesicles. El-Gholl *et al.* (1992) subsequently described the heterothallic teleomorph as *Calonectria spathiphylli* El-Gholl *et al.* Furthermore, additional hosts such as *Heliconia*, *Ludwigia* and *Strelitzia* were reported for this species, while Crous & Wingfield (1994) also listed it on *Araucaria*.

The Mauritian isolate (IMI 167983) has conidia which are (1-)3-septate, (55-)90(-120) x (6-)6.5(-7) μm . El-Gholl *et al.* (1992) reported that cultures of *C. spathiphylli* were primarily 1(-3)-septate, 39-148 x 4.5-8 μm , thus corresponding with our isolate. Furthermore, IMI 167983 also produced a distinct microconidial state on CLA. Conidia are 1-septate, (32-)39(-50) x (3.5-)4(-5) μm , and form on straight cylindrical to allantoid phialides, 10-26 x 3-3.5 μm . No microconidial vesicles were, however, observed. This is the first report of a microconidial state for *C. spathiphylli*, and a new host and geographic record for the species.

Isolate IMI 167983 was mated with several predetermined tester strains of *C. spathiphylli* (El-Gholl *et al.*, 1992), namely P87-0167 (+, from *Heliconia*), P91-7693 (+, from *Ludwigia*), P86-0210 (-, from *Heliconia*) and P91-1735 (-, from *Strelitzia*). A few strains of undetermined mating type from *Heliconia* spp. were also included, namely P89-0823, P89-1685, P88-0321, as well as an isolate from Switzerland, K2C (from *Spathiphyllum*).

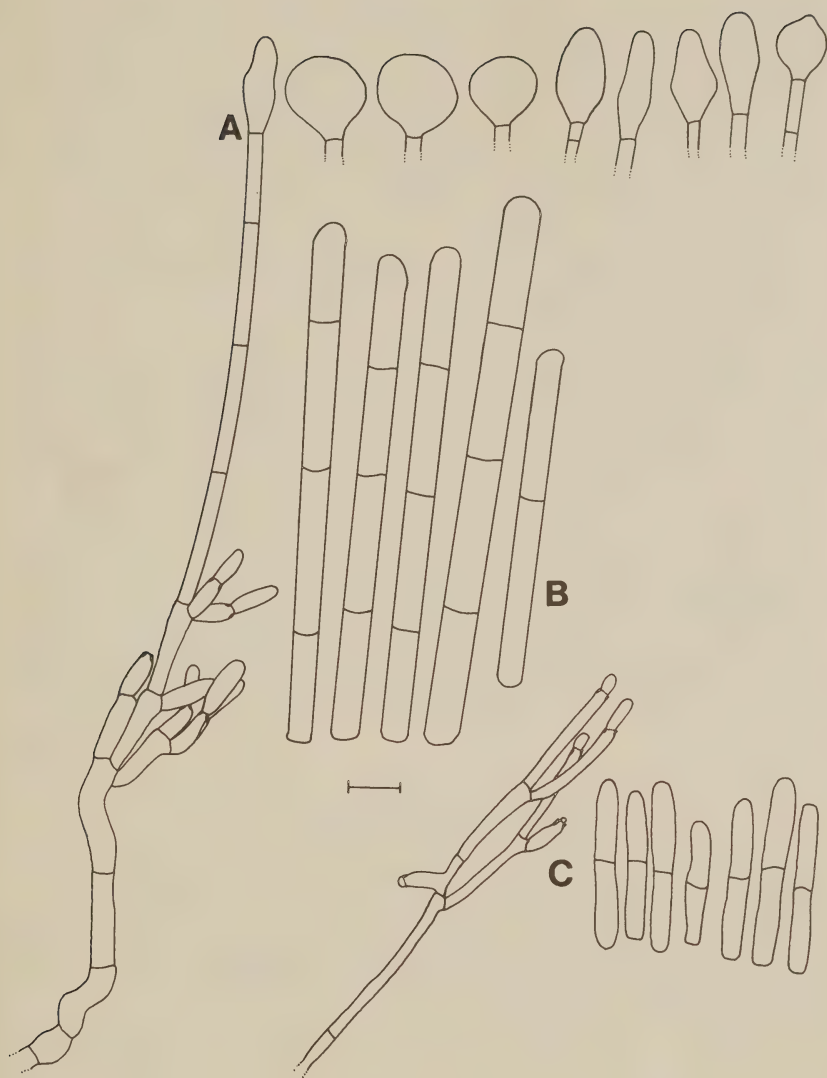


Fig. 2A-C. *Cylindrocladium spathiphylli*. A. Penicillate macroconidiophore with vesicles. B. Cylindrical 1-3-septate macroconidia. C. Microconidiophore with 1-septate microconidia (bar = 10 μ m).

Perithecia with viable ascospores were obtained within 2 mo at 25°C on the laboratory bench. Isolate IMI 167983 mated with (-) strains, namely P91-1735, P86-0210, P89-1685, P88-0321, P89-0823 and K2C, confirming it to be a (+) mating type, and a strain of *C. spathiphylli*. It can therefore be accepted that although vesicle morphology is characteristic of the various species of *Cylindrocladium*, some species are characterized by a certain amount of variation in their vesicles, as has also been reported for *C. variabile* Crous *et al.* (Crous *et al.*, 1993b). Further studies on the various species complexes using a combination of molecular techniques and sexual compatibility are required, therefore, to determine the amount of variation acceptable within each biological species.

The formation of microconidial states in *Cylindrocladium* is poorly understood (Crous & Wingfield, 1994). Although these states are much less common than in morphologically similar genera such as *Cylindrocarpon* Wollenw. and *Fusarium* Link, some species of *Cylindrocladium* are nearly always isolated with both conidial types (*C. ovatum*, *C. pteridis* Wolf, *C. variabile*), whereas this is rarely observed in others (Peerally, 1991; Crous & Wingfield, 1994). In the case of strain IMI 167983 of *C. spathiphylli*, it would seem that long term preservation induced the ability to form both conidial states, as has also been observed for strain CBS 190.50 of *C. parasiticum* Crous *et al.* (Crous *et al.*, 1993c). This suggests, therefore, that the formation of microconidia in some species of *Cylindrocladium* may only be due to unfavourable conditions, and be of little value as an additional taxonomic feature.

ACKNOWLEDGMENTS

The authors are grateful to Dr. N.E. El-Gholl (Florida Dept. of Agric. & Consumer services) and Dr. L. Petrini (Tèra d'Sott 5, Comano, Switzerland), for placing their strains of *C. spathiphylli* at our disposal. Dr. El-Gholl and the curators of CBS and IMI are also thanked for strains of *G. tenuis* examined in this study.

REFERENCES

- Agnihotrudu, V. (1959). Notes on fungi from North-East India. *Transactions of the British Mycological Society* **42**, 458-462.
- Barron, G.L. (1968). The genera of Hyphomycetes from soil. Williams & Wilkins Co., Baltimore, MD, U.S.A.
- Crous, P.W., Alfenas, A.C. & Wingfield, M.J. (1993a). *Calonectria scoparia* and *Calonectria morganii* sp. nov., and variation among isolates of their *Cylindrocladium* anamorphs. *Mycological Research* **97**, 701-708.
- Crous, P.W., Janse, B.J.H., Victor, D., Marais, G.F. & Alfenas, A.C. (1993b). Molecular characterization of *Cylindrocladium* spp. with three-septate conidia and ovoid-like vesicles. *Systematic and Applied Microbiology* **16**, 266-273.
- Crous, P.W., Phillips, A.J.L. & Wingfield, M.J. (1991). The genera *Cylindrocladium* and *Cylindrocladiella* in South Africa, with special reference to forestry nurseries. *South African Forestry Journal* **157**, 69-85.
- Crous, P.W. & Wingfield, M.J. (1993). A re-evaluation of *Cylindrocladiella*, and a comparison with allied genera. *Mycological Research* **97**, 433-448.
- Crous, P.W. & Wingfield, M.J. (1994). A monograph of *Cylindrocladium*, including anamorphs of *Calonectria*. *Mycotaxon* **51**, 341-435.
- Crous, P.W., Wingfield, M.J., & Alfenas, A.C. (1993c). *Cylindrocladium parasiticum* sp. nov., a new name for *C. crotalariae*. *Mycological Research* **97**, 889-896.
- Crous, P.W., Wingfield, M.J., Alfenas, A.C. & Silveira, S.F. (1994). *Cylindrocladium naviculatum* sp. nov., and two new vesiculate hyphomycete genera, *Falcocladium* and *Vesiculomyces*. *Mycotaxon* **50**, 441-458.
- El-Gholl, N.E., Uchida, J.Y., Alfenas, A.C., Schubert, T.S., Alfieri, S.A. & Chase, A.R. (1992). Induction and description of perithecia of *Calonectria spathiphylli* sp. nov. *Mycotaxon* **45**, 285-300.
- Matsushima, T. (1971). Microfungi of the Solomon Islands and Papua-New Guinea. Published by the author, Kobe, Japan. 78pp., 169 figures, 48 plates.
- Peerally, A. (1991). The classification and phytopathology of *Cylindrocladium* species. *Mycotaxon* **40**, 323-366.
- Rayner, R.W. (1970). A mycological colour chart. CMI and British Mycological Society. Kew, Surrey, England.
- Saksena, S.B. (1954). A new genus of Moniliaceae. *Mycologia* **46**, 660-666.

- Schoutties, C.L., El-Gholl, N.E. & Alfieri, S.A. (1982). *Cylindrocladium spathiphylli* sp. nov. *Mycotaxon* **16**, 265-272.
- Uchida, J.Y. & Aragaki, M. (1992). Further characterization of *Cylindrocladium spathiphylli* from *Spathiphyllum* in Hawaii and Florida. *Mycologia* **84**, 810-814.
- Watanabe, T. (1994). *Cylindrocladium tenue* comb. nov. and two other *Cylindrocladium* species isolated from diseased seedlings of *Phellodendron amurense* in Japan. *Mycologia* **86**, 151-156.

MYCOTAXON

Volume LVIII, pp. 129-135

April-June 1996

POLYPORES FROM BONIN IS. (JAPAN) II TWO NEW SPECIES OF PHELLINUS (HYMENOGASTRACEAE, BASIDIOMYCOTINA)

by

TSUTOMU HATTORI

Forestry and Forest Products Research Institute,
P.O.Box 16, Tsukuba Norin Kenkyu Danchi-nai,
Ibaraki, Japan 305

and

LEIF RYVARDEN

Dept. of Botany, Inst. Biology, Univ. of Oslo,
P.O.Box 1045, N-0316 Oslo, Norway

SUMMARY

Two new species of Hymenochaetaceae are described from Bonin Is., Japan. *Phellinus macroferreus* sp. nov. is characterized by effused-reflexed, woody basidiocarps and cylindrical spores. *Phellinus velutinus* sp. nov. is characterized by resupinate and fibrous basidiocarps, long acuminate setae, and abundant setal hyphae. Cultural characteristics of *P. macroferreus* are also described.

Key words : *Phellinus macroferreus*, *Phellinus velutinus*, Hymenochaetaceae, polypores, Bonin Is.

INTRODUCTION

During the Second General Survey of the Natural Environment of the Ogasawara (Bonin) Islands (1990-1991) many specimens of polypores were collected by the senior author and other mycologists. Among them 2 species of *Phellinus* did not key out in either the world monograph of *Phellinus* by Larsen & Cobb-Poulsen (1990), the key of Malaysian species of xanthochroic polypores by Corner (1991) or in other literature on polypores. We conclude that these 2 species are undescribed and the names *Phellinus macroferreus*, *P. velutinus* are proposed.

METHODS

Dried specimens were examined both macroscopically and microscopically. Cultures of *P. macroferreus* were grown at 25 °C in the dark on PDA (Eiken Chem Co. Ltd.). The effect of temperature on mycelial growth was established by incubation at constant temperature from 4 to 40 °C at intervals of 3 °C. Five replicates were made for each temperature. Colony growth rate K_r for each temperature was calculated from the following equation:

$$R_1 = R_0 + K_r(t_1 - t_0)$$

where R_1 = colony radius at time t_1 , R_0 = colony radius at time t_0 .

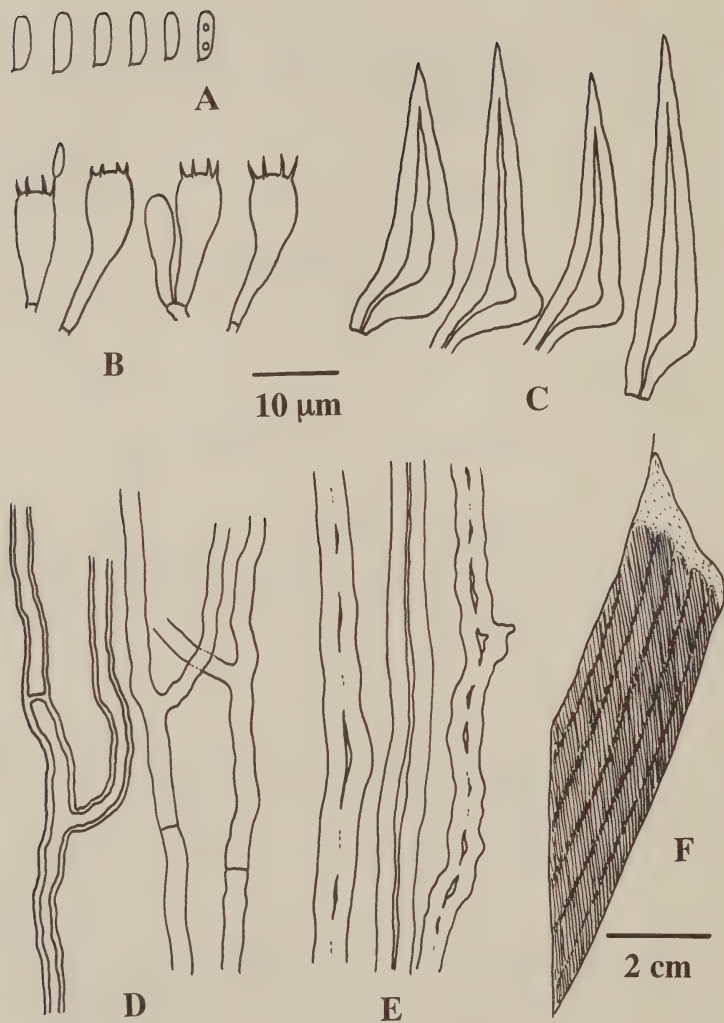


Fig. 1. *Phellinus macroferreus*. Structures from basidiocarp. A, basidiospores; B, basidia; C, setae; D, generative hyphae from the context; E, skeletal hyphae from the context; F, section of the basidiocarp. From the holotype.

The species code of Nobles (1965) for 6-week-old cultures was described. Extracellular oxidase reactions were tested according to Davidson et al. (1938), Nobles (1958), Kåårik (1965), and Harkin et al. (1974).

Colors of the basidiocarp and culture were described according to Kornerup and Wanscher (1981).

Herbaria where specimens are deposited were abbreviated according to Holmgren et al (1990).

DESCRIPTION

Phellinus macroferreus Hattori & Ryvarden sp. nov.

Basidiocarp effuso-reflexus unguatus vel triquetrus; poris ochraceis, angulatis, 6-8 / mm; tubi ochracei, -4 cm longi; caro -1 cm crassa, ochracea, lignea. Systema hypharum dimiticum, generatrices 1.5-3.5 μ m latae, skeletales 2.5-5 μ m latae in dissepimentis; setae conicae acutae copiosae; sporae cylindricae, 6.5-7.5 x 2-2.5 μ m, hyalinae, non-amyloideae. Holotypus: Minamizaki, Hahajima I., Bonin Is., ad truncum *Raphiolepis wrightiana* Maxim. (Rosaceae), leg. T. Hattori, 28 Nov. 1990. (TNS). Isotypi : TFM, O, K, BPI.

Macroscopic and microscopic characteristics

Basidiocarp effused-reflexed, widely effused, perennial; pilei unguate to triquetrous, narrow, up to 30 x 3 cm; upper surface brown to almost black near the base, glabrous, not sulcate and almost smooth, with a thin dark crust; margin cinnamon to yellowish brown, faintly tomentose to almost glabrous, rounded; pore surface yellowish to grayish brown (6 D-E 5-7), pores angular, 6-8 / mm with entire dissepiments; tubes up to 4 cm deep in the type material, concolorous with the context, woody, each layer up to 1 cm thick; context rusty brown (6-7 D 8), up to 1 cm thick, hard and woody.

Contextual hyphae dimitic, generative hyphae 1.5-3.5 μ m wide, hyaline, thin to slightly thick-walled (up to 0.5 μ m thick), moderately branched, without clamp connections; context skeletal hyphae 2.5-5 μ m wide, rusty brown, thick-walled to almost solid (wall 1-2.5 μ m thick), unbranched; tramal hyphae almost the same as in context; setae abundant in the hymenium, subulate to subventricose, acute and straight, brown, 25-40 x 6.5-9 μ m; basidia 12-18 X 4.5-5.5 μ m, clavate, with 4 sterigmata, without a basal clamp; spores cylindrical, 6.5-7.5 x 2-2.5 μ m, hyaline, IKI- (Fig. 1).

Specimens examined: type, indicated above (TFM-F-15943); Anijima I., Bonin Is., Japan, on *Schima mertensiana* (Sieb. & Zucc.) Koidz. (Theaceae), leg. H. Neda, 18 Mar. 1990 (TFM-F-16069).

Cultural characteristics

Growth characteristics: The effect of temperature on mycelial growth rate is shown in Fig. 2. Growth moderately rapid (4.6 mm / day, 25 °C), optimum temperature 28 °C, no growth below 7 °C or above 37 °C. Advancing zone even, hyaline and appressed for short distance, soon raised. Mat white, then yellowish orange (4-5 B 7-8) to light brown (5 C-D 8), felty to woolly. No fruiting is observed. Reverse unchanged. No odor.

Microscopic characteristics: Hyphae of advancing zone hyaline, branched, with simple septa, 2.5-5 μ m wide. Hyphae of aerial and submerged mycelium (a) hyaline to yellow, thin-walled to slightly thick-walled (wall up to 0.5 μ m thick), branched, with simple septa, 1.5-4.5 μ m wide. (b) fiber hyphae brown, thick-walled (wall up to 1.5 μ m thick), 1.5-3.5 μ m wide (Fig. 3).

Species code: 2, 6, 8, 32, 37, 38, 43, 54.

Extracellular oxidase reactions: 0.5% gallic acid + ; 0.5% tannic acid + ; gum guaiac + ; syringaldazine + ; α -naphthol + ; p-cresol + ; tyrosine + .

Culture examined: FFPRI-F-WD-841, isolated from basidiocarp tissue of the type material, deposited in MAFF Gene Bank.

Phellinus velutinus Hattori & Ryvarden sp. nov.

Basidiocarpus resupinatus; poris ferrugineis, angulatis, 6-7 / mm; tubi ferruginei velutini, -2 mm longi, caro -1 mm crassa, velutinea. Systema hypharum dimiticum, generatrices

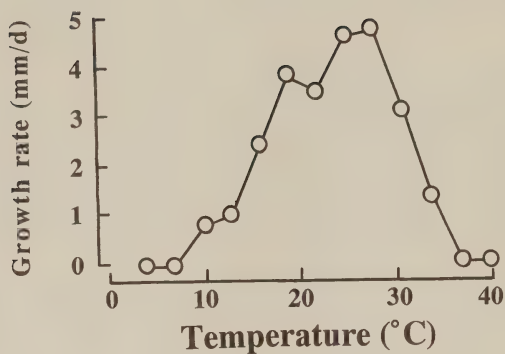


Fig. 2. Effect of temperature on mycelial growth of *Phellinus macroferreus*.

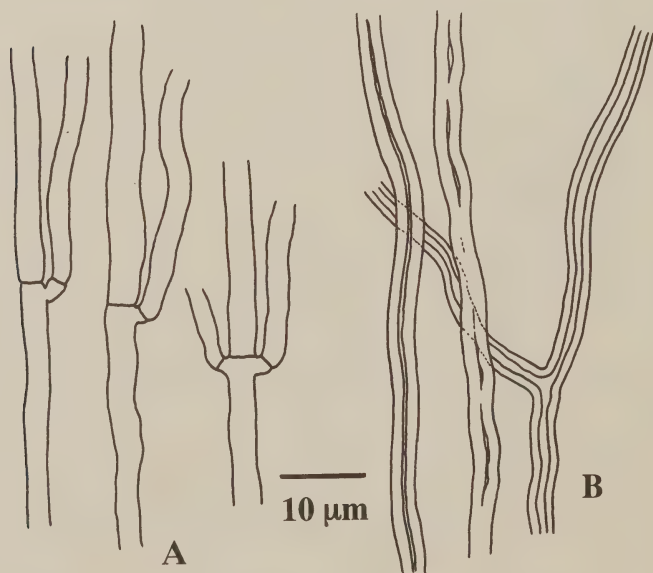


Fig. 3. *Phellinus macroferreus*. Structures from culture. A, generative hyphae from the advancing zone; B, fiber hyphae from the aerial mycelium.

2-3 μm latae, hyalinae vel ferrugineae, skeletales 2-3.5 μm latae in caris; setal hyphae multae, 6-7 μm latae, 170-220 μm longae in dissepimentis, -250 μm in caris, acutae; setae conicae vel ventricosae acutae copiosae; sporae ellipsoideae, 4-5 x 2.2-3 μm , hyalinae, non-amyloideae. Holotypus: Iguma-dani, Hahajima I. Bonin Is., ad truncum ? *Ficus microcarpa* L.f. (Moraceae), leg. T. Hattori, 27 Nov. 1990. (TNS). Isotypi : TFM, O, K, BPI.

Macroscopic and microscopic characteristics

Basidiocarp resupinate, widely effused, soft and brittle, adnate to separable from the substrata, up to 4 mm thick; margin narrow to wide, up to 5 mm wide, fibrous-cottony, yellowish brown (5-6 D 8); pores yellowish to reddish brown (5-6 D-E 8), pores angular, 6-7 / mm, dissepiments moderate and entire, tubes concolous, up to 2 mm deep; context thin, up to 1 mm thick, cottony, yellowish brown (5-6 D 8).

Contextual hyphae dimitic, generative hyphae 2-3 μm wide, hyaline to yellow, thin to slightly thick walled (up to 0.5 μm thick), without clamp connections, skeletal hyphae 2-3.5 μm wide, yellow to reddish brown, thick walled (0.5-1.5 μm thick), setal hyphae abundant, up to 250 μm long, 5-7 μm wide, reddish brown, acute and straight, thick walled (up to 3 μm thick); tramal hyphae dimitic, generative hyphae 1.5-2.5 μm wide, hyaline to pale yellow, thin to slightly thick walled (up to 0.5 μm thick), without clamp connections, skeletal hyphae 2-3 μm wide, yellow to reddish brown, thick walled (0.5-1 μm thick), setal hyphae abundant, buried in the trama, 170-220 μm long, 6-7 μm wide, reddish brown, acute and almost straight, thick walled (up to 3 μm wide); setae abundant in the hymenium, 50-75 μm long, 7.5-10 μm wide, reddish brown, subulate to subventricose, acute; basidia cylindrical, 10-13 μm long, 4.5-5 μm wide, with 4-sterigmata; basidiospores ellipsoid, 4-5 x 2.2-3 μm , hyaline, IKI⁻ (Fig. 4).

Specimens examined: type, indicated above (TFM-F-15935); Anijima I., Bonin Is., Japan, on *Psychotria homalosperma* A. Gray, (Rubiaceae), leg. H. Neda, 18 Mar. 1990 (TFM-F-16067).

DISCUSSION

The genus *Phellinus*, typified by *Polyporus rubriporus* Quél. (= *Polyporus torulosus* Pers.) is one of the largest genera in the polypores. Larsen & Cobb-Pouille (1990) made a survey of the world species of this genus and 221 species were recognized. Later, Corner (1991) described a number of *Phellinus* spp. including 15 new taxa from Malaysia.

Phellinus macroferreus is characterized by the apparently pileate basidiocarps, subulate setae, and cylindrical spores. *Phellinus ferreus* (Pers.) Bourd. & Galz., with same type of spores and setae, is probably the most closely related species. Nevertheless, this species always has a resupinate basidiocarp while *P. macroferreus* has a pileate and ungulate to triquetrous basidiocarp. *Phellinus tawhai* (Cunn.) Cunn., endemic in New Zealand, also has the same type of spores and setae. Basidiocarps of this species are effused-reflexed with numerous nodose pilei arising from a broad resupinate foot according to Cunningham (1965) while those of *P. macroferreus* are effused-reflexed with a single large pileus. Besides, basidiospores of *P. tawhai* are smaller (5-6 x 1.5-2 μm) than those of *P. macroferreus*.

Phellinus cinchonensis (Murr.) Ryv. has a semi-applanate to ungulate basidiocarp, subulate setae and cylindrical spores as in *P. macroferreus*. But the former species has a light basidiocarp, fragile tubes and a radially fibrous context according to Lowe (1957) and Ryvarden & Johansen (1980) while *P. macroferreus* has a heavy basidiocarp and woody hard context and tubes. Furthermore, basidiospores of the former species are wider (2.5-3 μm wide) and generally more oblong ellipsoid than strictly cylindrical. *Phellinus cylindrosporus* Ryv., described by Ryvarden (1987) from Panama, also has a pileate basidiocarp, cylindrical basidiospores and abundant setae, but this species differs from *P. macroferreus* in its basidiocarps with a strongly contracted base and strongly zonate surface.

Phellinus velutinus is characterized by an entirely resupinate basidiocarp, soft spongy tubes, long subulate setae and abundant setal hyphae. *Phellinus palmicola* (Berk. & Curt.) Ryv. (holotype, K!) seems to be the closest relative of this species, both species

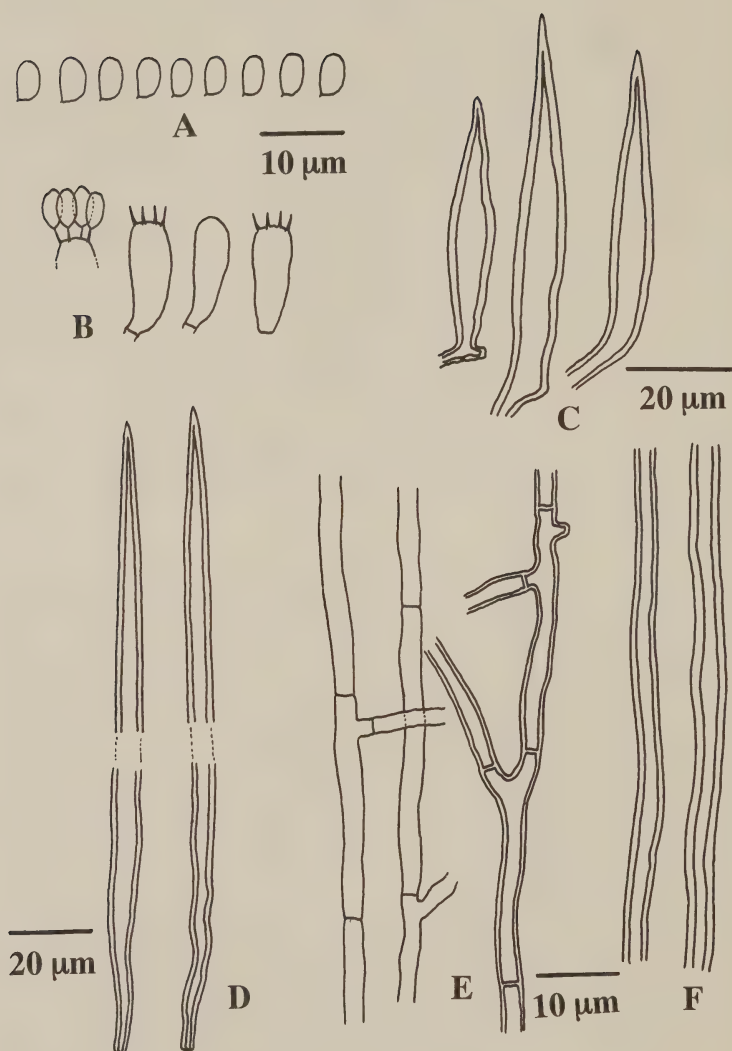


Fig. 4. *Phellinus velutinus*. Structures from basidiocarp.
 A, basidiospores; B, basidia; C, setae; D, setal hyphae from the context;
 E, generative hyphae from the context; F, skeletal hyphae from the context.
 From the holotype.

having resupinate and soft basidiocarps and long subulate setae. They differ in pore size which is small in *P. velutinus* and very large in *P. palmicola*, and in the presence of setal hyphae which are abundant both in the context and trama of the former species and absent in *P. palmicola*. Besides, *P. palmicola* is known only from palms according to Gilbertson & Ryvarden (1987) while both collections of *P. velutinus* were on angiosperms. Both *P. contiguus* (Fr.) Pat. and *P. rufitinctus* (Cke) Pat. also have resupinate basidiocarps, subulate to subventricose setae, abundant setal hyphae and ellipsoid and hyaline spores but the consistency of the basidiocarps is much harder than in *P. velutinus*. In addition, *P. contiguus* has much larger pores and *P. rufitinctus* has smaller basidiospores. *Phellinus lamaensis* (Murr.) Heim (holotype, NY!) sometimes has a resupinate basidiocarp, with setal hyphae and setae. However, it has much shorter hymenial setae (rarely above 25 μm long), its basidiospores are obovate and wider (3.5-5 x 2.5-3.5 μm) and its tubes are very rigid.

ACKNOWLEDGMENTS

We wish to express our thanks to Dr P. Buchanan, Manaaki Whenua-Landcare Research, New Zealand, for critical review of the manuscript. We are also grateful for the curators of Kew Herbarium and Herbarium of New York Botanical Garden for the loan of type materials. T. H. is grateful for Dr. M. Ono, Tokyo Megar. Univ. for the arrangement of the survey of Bonin Is.

LITERATURE CITED

- Corner, E. J. H. 1991: Ad polyporaceas VII, the xanthochroic polypores. Beih. Nova Hedw. 101: 1-175.
- Cunningham, G. H. 1965: Polyporaceae of New Zealand. New Zealand Dept. Sci. Ind. Res. Bull. 164: 1-304.
- Davidson, R. W., Campbell, W. A., and Blaisdell, D. J. 1938: Differentiation of wood-decaying fungi by their reaction on gallic or tannic acid medium. J. Agric. Res. 57: 682-695.
- Gilbertson, R. L. & Ryvarden, L. 1987: "North American Polypores" 885 pp. Fungiflora, Oslo.
- Harkin, J. M., Larsen, M. J. and Obst, J. R. 1974: Use of syringaldazine for detection of laccase in sporophores of wood rotting fungi. Mycologia 66: 469-476.
- Holmgren, P. K., Holmgren, N. H. & Barnett, L. C. 1990: "Index Herbariorum, 8th ed." N. Y. Bot. Gdn., New York.
- Kåårik, A. 1965: The identification of the mycelia of wood decaying fungi by their oxidation reactions with phenolic compounds. Stud. For. Suec. 31: 1-80.
- Kornerup, A. and Wanscher, J. H. 1981: Methuen Handbook of color, third ed., reprint. 252 pp.
- Larsen, M. J. & Cobb-Pouille, L. A. 1990: *Phellinus* (Hymenochaetaceae), a survey of the world taxa. Synopsis 3: 1-204.
- Lowe, J. L. 1957: Polyporaceae of North America. The genus *Fomes*. State Univ. N. Y. Coll. Forestry Techn. Publ. 65: 1-91.
- Nobles, M. K. 1958: A rapid test for extracellular oxidases in cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 36: 91-99.
- Nobles, M. K. 1965: Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43: 1097-1139.
- Ryvarden, L. 1987: New and noteworthy Polypores from tropical America. Mycotaxon 28(2): 525-541.
- Ryvarden, L. & Johansen, I. 1980: "A Preliminary Polypore Flora of East Africa" 636 pp. Fungiflora, Oslo.

NOTES ON HYPHOMYCETES. LXXII.
FURTHER NOVEL LEAF SPOT-INDUCING SPECIES
OF PHAEORAMULARIA FROM THE INDIAN SUBCONTINENT

SANJAY K. SINGH and RITESH K. CHAUDHARY

Department of Botany, University of Gorakhpur,
Gorakhpur 273009, India

and

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture,
Auburn University, Alabama 36849

ABSTRACT

Three hitherto unknown species of *Phaeoramularia* Muntañola, *P. ficina* S.K. Singh et R.K. Chaudhary, *P. calotropicola* S.K. Singh et R.K. Chaudhary, and *P. pyrigena* S.K. Singh et R.K. Chaudhary, collected on living leaves of *Ficus heterophylla* L., *Calotropis gigentia* R.Br., and *Pyrus pashia* Bush.-Ham., respectively, are described, illustrated, and compared with allied taxa. Each causes necrotic leaf lesions on its host plant. The former is reported from India, the latter two were collected in Nepal.

INTRODUCTION

The genus *Phaeoramularia* Muntañola currently contains well over seventy species and new taxa continue to be added to it (Singh, Chaudhary and Morgan-Jones, 1995). Seventeen novel species have been described from the Indian subcontinent during the past twenty years and there undoubtedly exist many others that remain to be discovered. Comments were made by Singh *et al.* (loc. cit.) on the state of the genus and in particular on the matter of taxonomic concepts where host association, as well as morphological distinctions, play a role in differentiating species. Although very many of the described species bear similarity to each other, morphological differences and conidiophore and conidium dimensions, as well as host relationships, serve to effectively distinguish most of the various taxa. In the present publication three further hitherto undescribed species, one from the Terai belt, between the river Ganges and the foothills of the Himalayas, in northeastern Uttar Pradesh, India, the others from Nepal, are treated. Infection by all three results in necrotic leaf-spot symptoms on their respective host leaves.

TAXONOMIC PART

Phaeoramularia ficina S.K. Singh et R.K. Chaudhary, sp. nov. (Figure 1).

Maculae hypogaeae, primo parvae et venis limitatae, deinde irregulariter, plerumque effusae et extensae, pallide vel medio brunneae. Caespituli hypophylli, effusi, pallide brunnei. Mycelium immersum, ex hyphis subhyalinis vel pallide olivaceis, septatis, ramosis, laevibus, usque ad $3\mu\text{m}$ crassis compositum. Stromata substomatalia, pseudoparenchymatica, parva, pallide brunnea, $14\text{--}16\mu\text{m}$ lata. Conidiophora ex cellulis superis stromatum oriunda, semi-macronemata vel macronemata, mononemata, fasciculata, saepe ramosa, recta vel flexuosa, laevia, cylindrica, plus minusve ad apice pallide olivacea, 1 ad 3-septata, $13.5\text{--}50 \times 2.5\text{--}4.5\mu\text{m}$. Cellulae conidiogenae in conidiophoris integratae, terminales, polyblasticae, sympodiales, cicatricatae; cicatrices conidiales conspicuae, incrassatae, circa $1\mu\text{m}$ diam. Conidia holoblastica, acropleurogena, sicca, plerumque recta vel leniter curvata, solitaria vel interdum catenulata, in catenas simplicia vel ramosas formata, subcylindrica vel obclavata, ad apice obtusa, laevia, subhyalina vel pallide olivacea, 1 ad 14-septata, in hila incrassata breviter attenuata, $18\text{--}63 \times 1.5\text{--}4.5\mu\text{m}$.

In foliis vivis *Fici heterophyllae*, Banki Forest, Gorakhpur, Uttar Pradesh, India, May 1992, Kamal, HClO 30857, holotypus; GPU Herb. No. 2010, AUA, isotypi.

Leaf lesions hypogenous, initially small and vein limited, often appearing at first as ill-defined, irregularly-shaped, pale cinnamon-brown blotches, later spreading, sometimes to cover a large portion of the leaf, mid cinnamon-brown, more or less evenly colored, or with the extreme margin very slightly darker. Caespituli hypophyllous, effuse, pale brown. Mycelium immersed in the leaf tissue, composed of subhyaline to pale olivaceous, septate, branched, smooth, up to $3\mu\text{m}$ wide hyphae. Stromata substomatal, pseudoparenchymatous, small or rudimentary, pale brown, $14\text{--}16\mu\text{m}$ wide. Conidiophores arising from the cells of the stromata, emerging through stomata, semi-macronematous to macronematous, mononematous, fasciculate, usually in small fascicles of three to five, simple or occasionally branched, more or less straight or, more often, flexuous, smooth, cylindrical, sometimes somewhat geniculate toward the fertile apex, pale brown at the base, pale olivaceous distally, 1 to 3-septate, $13.5\text{--}50 \times 2.5\text{--}4.5\mu\text{m}$. Conidiogenous cells integrated, terminal, polyblastic, sympodial, cicatrized, bearing thickened, conspicuous scars; scars about $1\mu\text{m}$ in diameter, usually up to six. Conidia holoblastic, acropleurogenous, dry, frequently straight or slightly curved, solitary or sometimes catenulate, subcylindrical to narrowly obclavate, obtuse at the apex where terminal, smooth, subhyaline to pale olivaceous, 1 to 14-septate (mostly 3 to 8-septate), bearing one or more moderately thickened hila, $18\text{--}63 \times 1.5\text{--}4.5\mu\text{m}$; ramoconidia usually with two apical or subapical scars. Conidial chains, where present, simple or, less frequently, branched.

On living leaves of *Ficus heterophylla* L. (Moraceae); India.



FIGURE 1. *Phaeoramularia ficina*. Stroma, conidiophores and conidia.

Collection examined: on *F. heterophylla*, Banki Forest, Gorakhpur, Uttar Pradesh, India, May 1992, Kamal, HClO 30857, holotype; GPU Herb. No. 2010, AUA, isotypes.

Phaeoramularia ficina is readily distinguishable from other described species of the genus by a combination of conidium shape, size, and extent of septation. The occasional branching of the conidiophores is another distinctive feature. Another species having a comparable degree of conidium septation is *P. leptadeniae* (Chiddarwar) Deighton, which occurs on leaves of *Leptadenia reticulata* Wight [Asclepiadaceae] in India and the Sudan (Chiddarwar, 1960; Ellis, 1976). The conidia of that species are much longer than those of *P. ficina*. Several other species also have conidia exceeding 100µm in length. These include *P. acericola* Liu & Guo, *P. helianthi* Liu & Guo, and *P. meridiana* (Chupp) Deighton (Liu and Guo, 1982; Deighton, 1979). *P. ficina* is the only species known to occur on a member of the Moraceae.

Phaeoramularia calotropicola S.K. Singh et R.K. Chaudhary, sp. nov. (Figure 2).

Maculae amphigenae, irregulares, brunneae vel atrobrunneae, extensae, interdum coalescentes. Caespituli hypophylli, effusi, breviter floccosi, atrobrunnei. Mycelium immersum, ex hyphis hyalinis vel subhyalinis, septatis, ramosis, laevibus, usque ad 3µm crassis compositum. Stromata substomatalia, pseudoparenchymatica, parva, pallide brunnea, 9-10µm lata. Conidiophora ex cellulis stromatum oriunda, semi-macronemata vel macronemata, fasciculata, flexuosa, pallide brunnea vel pallide olivacea, simplicia ad interdum ramosa, 2 ad 6-septata, laevia, cylindrica, raro geniculata, 64-116 X 2.5-5.5 µm. Cellulae conidiogenae in conidiophoris integratae, terminales vel intercalares, monoblasticae vel polyblasticae, sympodiales, cicatricatae; cicatrices conidiales conspicuae, incrassatae, circa lum diam. Conidia holoblastica, acropleurogena, solitaria vel interdum catenulata, in catenas simplicia vel ramosa formata, sicca, recta vel leniter curvata, interdum undulata, cylindrica vel obclavata, laevia, subhyalina vel pallidissime brunnea, 1 ad 6-septata, in hila leniter incrassata breviter attenuata, 32-146 X 2.5-7µm.

In foliis vivis *Calotropis giganteae*, Naraingarh, Chitwan, Nepal, December 1993, Kamal, HClO 41713, holotypus; GPU Herb. No. 3052, AUA, isotypi.

Leaf lesions amphigenous, at first in the form of pale, yellowish-brown, irregular blotches or small chlorotic patches, later often spreading and coalescing to produce extensive areas of leaf discoloration, eventually becoming olivaceous brown to dark blackish-brown, more or less evenly colored. Caespituli hypophyllous, effuse, dark brown to blackish, appearing as very small spots, or mottling where numerous. Mycelium immersed in the leaf tissue, composed of subhyaline to olivaceous, septate, branched, smooth, up to 3µm wide hyphae. Stromata substomatal, small, poorly-developed, pseudoparenchymatous, more or less subglobose, 9-10µm wide, composed of a few swollen, compact, pale brown cells. Conidiophores arising from the cells of the stromata, semi-macronematous to mononematous, fasciculate, usually from four to five per fascicle, mostly flexuous and occasionally undulate, pale

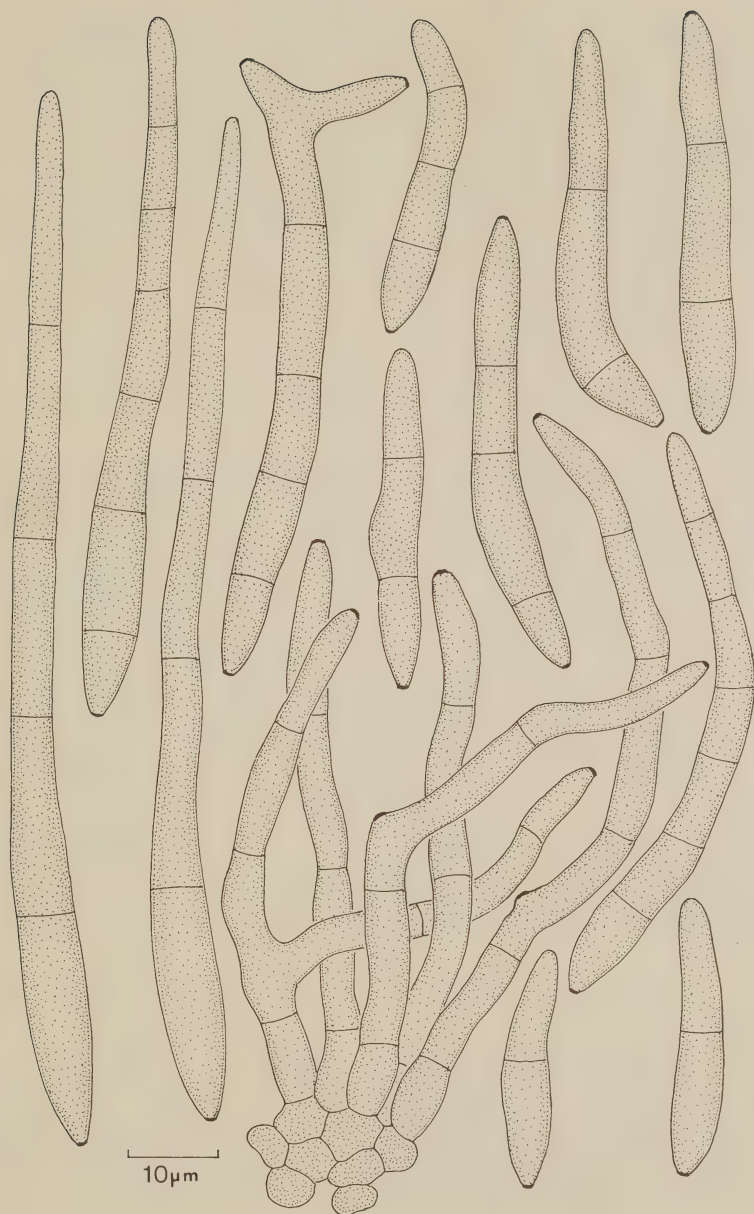


FIGURE 2. *Phaeoramularia calotropicola*. Stroma, conidiophores and conidia.

olivaceous brown, simple or sometimes branched, 2 to 6-septate, smooth, cylindrical, rarely slightly geniculate, 64–116 X 2.5–5.5µm. Conidiogenous cells integrated, terminal or occasionally intercalary, monoblastic or polyblastic, sympodial, cicatrized, bearing thickened, conspicuous, about 1µm in diameter, scars. Conidia holoblastic, acropleurogenous, mostly solitary or occasionally catenulate, dry, more or less straight or slightly curved or sometimes somewhat undulate, subcylindrical to narrowly obclavate, rarely with a short, lateral, fertile branch originating subapically, smooth, subhyaline to pale olivaceous-brown, 1 to 6-septate, attenuating toward each end, bearing one or more moderately thickened hila, 32–146 X 2.5–7µm; conidial chains, where present, short, simple or, more rarely, branched.

On living leaves of *Calotropis gigantea* (L.) Dryander ex W.T. Aiton (Asclepiadaceae); Nepal.

Collection examined: on *C. gigantea*, Naraingarh, Chitwan, Nepal, December 1993, Kamal, HClO 41713, holotype; GPU Herb. No. 3052, AUA, isotypes.

Phaeoramularia calotropicola is easily identifiable from other species of the genus by a combination of overall morphology and conidium length. In regard to the latter characteristic it resembles *P. pluchae* (Petrak & Ciferri) Deighton [= *Cercospora pluchae* Petrak & Ciferri], which causes pale brown necrotic lesions on leaves of *Pluchea odorata* Cass., a member of the Asteraceae (Petrak and Ciferri, 1930). The conidiophores in that species are also quite long (Ellis, 1976). Another species of *Phaeoramularia*, namely *P. calotropidis* (Ell. & Everh.) Kamal, Moses & R. Chaudhary [= *Cercospora calotropidis* Ell. & Everh.] is known to occur on a different species of *Calotropis* R. Br. This taxon causes blackish lesions on leaves of *Calotropis procera* (Aiton) Dryander ex W.T. Aiton (Kamal *et al.*, 1990). *Phaeoramularia calotropicola*, although morphologically somewhat similar, differs from it mainly in having less well-developed stromata and larger conidiophore and conidium dimensions, particularly length. Caespituli in *P. calotropidis* are produced amphigenously in contrast to those of *P. calotropicola*, which are always produced hypophyllously. Two further species of *Phaeoramularia* have hosts belonging to the phanerogamic plant family Asclepiadaceae. Both *Phaeoramularia leptadeniae*, mentioned earlier, and *P. pergulariae* Dublisch & Singh, which occurs on *Pergularia daemia* Chiov., are morphologically distinguishable from each other (Chiddarwar, 1960; Dublisch and Singh, 1977) and from *P. calotropicola*.

Phaeoramularia pyrigena S.K. Singh et R.K. Chaudhary, sp. nov. (Figure 3).

Maculae amphigenae irregulariter orbiculares vel irregulares, venis limitatae, parvae, pallide cinnereae vel atrobrunneae, usque ad 4mm latae. Caespituli hypophylli, discreti, olivacei vel brunnei. Mycelium immersum, ex hyphis subhyalinis vel pallide olivaceis, septatis, ramosis, laevibus, usque ad 2.5µm crassis compositum. Stromata substomatalia, pseudoparenchymatica, compacta, pallide brunnea, 18–28µm lata. Conidiophora ex cellulis superis stromatum oriunda, macronemata, mononemata, fasciculata, simplicia, raro



FIGURE 3. *Phaeoramularia pyrigena*. Stroma, conidiophores and conidia.

ramosa, recta vel flexuosa, laevia, cylindrica, geniculata, pallide brunnea vel olivacea, 1 ad 3-septata, 31-52 X 3-6µm. Cellulae conidiogenae in conidiophoris incorporate, terminales vel intercalares, polyblasticae, sympodiales, cicatricatae; cicatrices conidiales conspicuae, incrassatae, circa 1µm diam. Conidia holoblastica, acropleurogenae, sicca, recta vel leniter curvata, solitaria vel catenulata, in catenas simplicia vel ramosas formata, cylindrica, laevia, 0 ad 2-septata, pallide olivacea, in hila incrassata breviter attenuata, 10-31 X 1.5-4µm.

In foliis vivis *Pyri pashiae*, Horticulture Garden, Kathmandu Valley, Nepal, December 1993, Kamal, HClO 41490, holotypus; GPU Herb. No. 3301, AUA, isotypi.

Leaf lesions amphigenous, more or less circular to somewhat irregular, often vein limited, small, at first pale grayish-brown, later becoming dark blackish-brown, up to 4mm wide. Caespituli hypophyllous, discrete, olivaceous to brown. Mycelium immersed in the leaf tissue, composed of subhyaline to pale olivaceous, septate, branched, smooth, up to 2.5µm wide hyphae. Stromata substomatal, pseudoparenchymatous, compact, pale brown, 18-28µm wide. Conidiophores arising from the cells of the stromata, emerging through stomata, macronematous, mononematous, fasciculate, usually in fascicles of up to six or seven, simple, rarely branched, erect, straight or, more often, flexuous, smooth, cylindrical, usually somewhat geniculate, pale brown to olivaceous, 1 to 3-septate, 31-52 X 3-6µm. Conidiogenous cells integrated, terminal or sometimes becoming intercalary following sympodial conidiophore growth and septation, polyblastic, cicatrized, bearing thickened, conspicuous, about 1µm in diameter scars; usually two or three per cell. Conidia holoblastic, acropleurogenous, dry, straight or very slightly curved, solitary or catenulate, cylindrical, smooth, 0 to 2-septate, pale olivaceous brown, bearing one or more moderately thickened hila, 10-31 X 1.5-4µm; ramoconidia with usually two apical scars. Conidial chains, where present, simple or branched.

On leaves of *Pyrus pashia* Bush.-Ham. (Rosaceae); Nepal.

Collection examined: on *P. pashia*, Horticulture Garden, Kathmandu Valley, Nepal, December 1993, Kamal, HClO 41490, holotype; GPU Herb. No. 3301, AUA, isotypes.

Two other species of *Phaeoramularia*, *P. pruni* Guo & Liu and *P. pyricola* S.K. Singh & R.K. Chaudhary, are associated with the Rosaceae, the second occurring on the same host genus as *P. pyrigena*, *Pyrus* L. *Phaeoramularia pruni* was described on living leaves of an unnamed species of *Prunus* L. in Hubei Province, China (Guo, 1987). Although there is morphological similarity between *P. pyrigena* and *P. pruni* they differ in a number of respects. The stromata of *P. pruni* are much better developed and appreciably larger. Likewise, its conidia, although with some overlap, are longer than those of *P. pyrigena* and are up to 3-septate. *Phaeoisariopsis pyricola* is readily distinguishable from the two above-mentioned species in conidium dimensions and abundance of septation, having up to five transverse septa per conidium.

ACKNOWLEDGEMENT

We are again very grateful to Dr. Kamal, Department of Botany, University of Gorakhpur, who collected the microfungi described in this paper, for the opportunity to study them. The field studies in Nepal were made possible through the support of the Indian National Science Academy [INSA], New Delhi, and the Royal Nepal Academy of Science and Technology [RONSAT], Kathmandu. Dr. Kamal's visit to Nepal was hosted by Tribhuvan University, Kirtipur, Kathmandu. Prepublication review of the manuscript was provided by Dr. Roger D. Goos, University of Rhode Island, for which we are thankful.

LITERATURE CITED

- CHIDDARWAR, P.P. 1960. Contributions to our knowledge of the Cercosporae of Bombay State - II. *Indian Phytopathol.* 12(1959):111-121.
- PETRAK, F. and R. CIFERRI. 1930. Fungi dominicani. *Ann. mycol.* 28:377-420.
- DEIGHTON, F.C. 1979. Studies on *Cercospora* and allied genera. VII. New species and redispositions. *Mycol. Pap.* 144:1-56.
- DUBLISH, P.K. and P.N. SINGH. 1977. A new species of *Phaeoramularia* from India. *Sci. Cult.* 43:269.
- ELLIS, M.B. 1976. More Dematiaceous Hyphomycetes. CMI, Kew, England, 507 pp.
- GUO, Y-L. 1987. Studies on Hyphomycetes of Shennongjia IV. *Cercospora*, *Cercosporidium* and *Phaeoramularia*. *Acta. Mycol. Sin.* 6:225-228.
- KAMAL, A.S. MOSES and R. CHAUDHARY. 1990. Two new species and a new combination in *Phaeoramularia* from Uttar Pradesh, India. *Mycol. Res.* 94:714-717.
- LIU, X. and Y. GUO. 1982. Studies on some species of *Phaeoramularia* in China. *Acta Phytopath. Sin.* 12:1-15.
- SINGH, S.K., R.K. CHAUDHARY and G. MORGAN-JONES. 1995. Notes on Hyphomycetes. LXVII. Three new species of *Phaeoramularia* from Nepal. *Mycotaxon* 54:57-66.

MYCOTAXON

Volume LVIII, pp. 147-156

April-June 1996

NOTEWORTHY REPORTS ON **ANZIA** (LICHENIZED ASCOMYCOTINA) FROM SOUTHERN SOUTH-AMERICA

Susana Calvelo

Centro Regional Universitario Bariloche
Universidad Nac. del Comahue. CC 1336
8400, Bariloche. Río Negro. Argentina

ABSTRACT

Anzia afromontana is reported for the first time from Argentina and its distribution in southern South America is described. The occurrence of the genus **Anzia** Stizenberger in Argentina and Chile is discussed and it is concluded that this is the first valid record of the genus for Argentina.

INTRODUCTION

This paper is a further report based upon studies of the lichen flora of North-Western Patagonia **Nothofagus** forests, with special emphasis on Parmeliaceae s. lat. (Calvelo & Adler, 1992; 1994; Adler & Calvelo, 1993).

The genera **Anzia** and **Pannoparmelia** are characterized by having a so called spongiostromatum covering the lower surface. Stizenberger (1861) described **Anzia** in a restricted form, including species with ascospores of "lunulate" shape and "*numerosissimae*" per ascus. Müller Argoviensis (1889) described **Pannoparmelia** as a section of **Anzia** to include species with subglobose ascospores and asci with 8 spores. Darbishi-

re (1912), considering distinctive characters of them (number of spores per ascus, their shape and the structure of the spongiostratum) treated **Pannoparmelia** as a separate genus. Since then, this concept has been widely accepted (Zahlbruckner, 1932; Galloway, 1978; Eriksson, 1984; Yoshimura, 1987; Eriksson & Hawksworth, 1993). Nevertheless both genera are closely related. They can be placed in the Family Parmeliaceae (Eriksson & Hawksworth, 1987; Yoshimura, 1987; Calvelo & Adler, 1992) considering the ontogeny of the ascocarp (Henssen et al., 1981) and spongiostratum (Henssen & Dobelmann, 1987) and the type of conidial formation (Yoshimura, 1987). Anyhow, some authors place **Anzia** in Anziaceae (Poelt, 1973; Hale, 1983) and Elix (1993) considers that there is still "*some contention whether or not **Anzia** should be included in the Parmeliaceae*".

In the original description of the species **Anzia afromontana** (Santesson, 1986) various localities in East Africa (Kenya, Tanzania and Ethiopia) were reported. Its presence was also recorded from South America (Chile) but without any reference to the locality of collection, since the author had not examined material from this last country (Santesson, pers. comm.). Later, Uganda was added to the distribution in Africa (Swinscow & Krog, 1988).

Here, the results of studies on material of **Anzia afromontana** specimens from southern South-America and Africa are presented, as well as a discussion regarding the presence of the genus **Anzia** in Argentina and Chile.

MATERIAL AND METHODS

Morphological, anatomical and photographic techniques were described in previous papers (Calvelo & Lorenzo, 1989; Calvelo & Adler, 1992). The identification of chemical substances was carried out by thin layer chromatography (Culberson, 1972; Culberson & Ammann, 1979).

Representative specimens of *Anzia afromontana* examined: ARGENTINA; Prov. de Chubut, Parque Nacional Lago Puelo, Río Turbio, on *Austrocedrus chilensis*, 8-XI-1992, S. Calvelo #607. CHILE; Prov. Llanquihue, Parque Nacional Vicente Pérez Rosales, Salto de Petrohue, Valdivian rainforest, on *Nothofagus dombeyi*, near a waterfall, 24-II-1973, leg. A. Henssen, G. Vobis and J. Redón 24287 (MB). KENYA; Central Prov., Nanyuki Dist., Mt. Kenya, W slope, National Park Road (Naro Moru Track), in a bamboo zone, on *Arundinaria alpina*, 0°10' S 37°11'-13' E, alt. 2900 m, 23-I-1970, leg. R. Santesson 22111 (UPS); on *Podocarpus milanjianus*, alt. 3100 m, 23-I-1970, leg. R. Santesson 22169 (UPS). TANZANIA; Arusha Prov., Mt. Meru, E-slope, c. 2 km N of Kitoto camp. 3°13' S 36°47' E, alt. 2450 m, on *Stoebe kili-manscharica* in a high and rather dense ericaceous bush land in the montane forest belt, 7-I-1971, leg. R. Santesson, 22949 (UPS - Holotypus). --- road to crater, Kitoto Camp, alt. ca. 2400 m, 3°14' S, 36°47' E, on *Olea africana*, in a montane forests, 17-I-1970, leg. R. Santesson, 21599 (UPS) UGANDA; Bugisu County, Bugisu, Mt. Elgon, near Sasa Mountain Hut, 1°10' N, 34°28' E, alt. 3090 m, on bark of shrubs in *Erica* zone, VI-1990, leg. T. Swinscow (det. R. Santesson) 2U 44/79 (UPS).

Specimens of *Anzia americana* examined: MEXICO; State of Oaxaca, trail leading to Cerro San Felipe, overlooking Oaxaca, 1-IV-1960, leg. Hale & Soderstrom 20697 (UPS).

RESULTS AND DISCUSSION

Anzia sect. Nervosae. Asah.

Chemical group: Divaricatic (Yoshimura, 1987)

Anzia afromontana Sant.

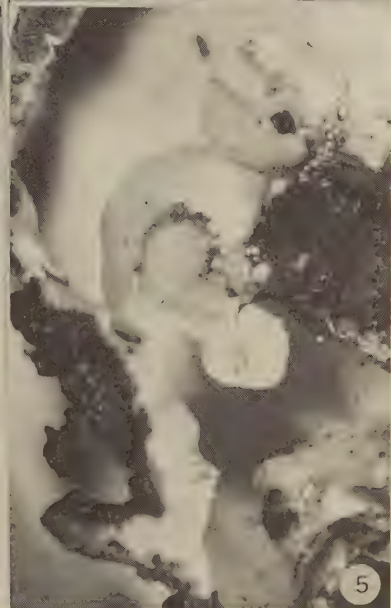
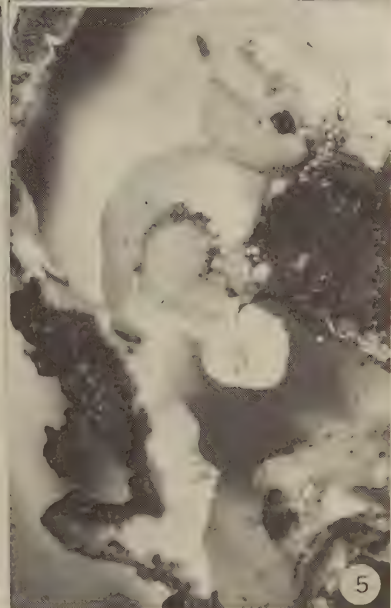
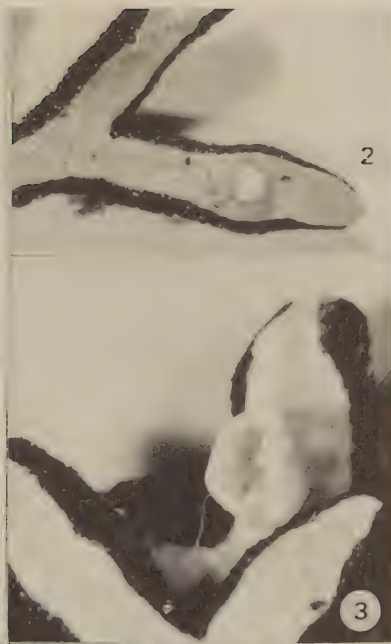
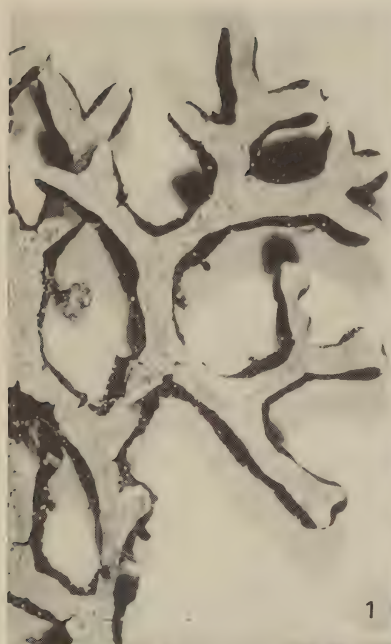
Santesson, R. 1986. Thunbergia 2:1

Thallus foliose, laciniate, subdichotomously branched, spreading over the substrate, up to 4 cm; laciniae up to 1.3 cm long, 1.2 mm wide, with

broad rounded apices (Fig. 1). Upper surface greenish grey, mat to glossy, apices pruinose to minutely pubescent. Photobiont Chlorococcales, *Trebouxia*. Medulla white. Central chondroid axis up to 180 μm diam., between the medulla and the spongiostratum, extending along the lobes, formed by longitudinal arranged hyphae. Lower surface ecorticate, except for a small margin at the apices; completely covered by a continuous brown-black spongiostratum, up to 1 mm thick, visible although beyond the margins. Spongiostratum made up of uniaxial, branching and anastomosing hyphae, 4.5-5 μm in diameter, forming a network. Rhizinae few, simple, with a squarrose tuft at the apex, black, up to 1.4 mm long. Thallus sor-
 radiate, with two types of soralia: 1. orbicular, laminar soralia, up to 1.3 mm in diameter (Figs. 2 and 3); 2. lower (occasionally upper) surface of round, globose apices of laciniae bursting out to form ventral soralia, up to 2.8 mm in diameter, solitary or gregarious (Figs. 4 and 5). Soredia fine, granular, white. Apothecia and pycnidia unknown.

Chemistry: atranorin and divaricatic acid.

Figs. 1-5. **Anzia afromontana**. Figs. 1-3 Holotypus 22949 (UPS). 1: Thallus habit (x3). 2: Orbicular, laminar soralia on upper surface of lobules (x5). 3: Detail of urn shaped laminar soralia on upper surface (x10). Figs. 4-5 Specimen from southern South-America (Calvelo #607). 4: Globose apices of laciniae seen from upper surface (x5). 5: Ventral surface of a lacinial apex bearing gregarious globose soralia, inner surface covered with powdery soredia (x10).



Remarks on types of soralia: The comparison between specimens from Africa, Argentina and Chile showed that the material from South America has a differential character since it presents two types of soralia:

Type 1- orbicular, laminar soralia, "*starting as small white points on the upper side of distal lobes, penetrating the cortex and finally forming urn-shaped structures with sorediate inner surface*" (Figs. 2 and 3), as those described in the species diagnosis (Santesson, 1986).

Type 2- soralia starting as globose outgrowths of the apices of laciniae, expanding to large protuberances and finally bursting out on the lower surface, to form globose ventral soralia (Figs. 4 and 5). They can be considered as a type of "cuff" soralia described by Yoshimura (1987). Not observed on material from Africa.

As the remaining morphological, anatomical and chemical characteristics are coincident with those of **Anzia afromontana**, this second type of soralia is here considered within the intraspecific variability, even when sorediate propagules are considered an appropriate character to segregate species (Yoshimura, 1987).

Anzia americana Yoshimura & Sharp, described from Mexican Highlands southeastern United States (Yoshimura & Sharp, 1968), has also ventral soralia but they are formed directly over the lower surface and do not have globose shape, being very easy to distinguish one from the other.

Distribution and Ecology: **Anzia afromontana** has a very particular disjunct distribution, having been found in Africa and southern South-America.

The South-American specimens of **Anzia afromontana** are typical for the Valdivian rainforest on both sides of the Andes. They have been collected in Lago Puelo National Park (Argentina)

and Vicente Pérez Rosales National Park (Chile) at ca. 41° S and 300 m altitude and in Laguna San Rafael National Park (Chile) at ca. 46° S (Galloway, 1992). The three areas are covered with temperate rainforest, with high, open canopy typically formed by *Drymis winteri*, *Lomatia ferruginea*, *Embothrium coccineum* and one of the two vicariant trees, *Nothofagus dombeyi* or *Nothofagus betuloides*. The understory is shrubby with *Chusquea* spp. (Bambusoideae), epiphytes and lianas. The African collections, were made in tropical rainforests, between 1° N and 3° S near the equator and at much higher altitudes (between 2000 and 3300 m). Some of them have also been reported from areas with vegetation of bamboo (Santesson, 1986 and in schaedt). The distribution shows the typical inverse correlation between altitude and degree of latitude (Begon et al., 1990).

Taxonomical remarks: Lamb (1958) made a new combination for *Pannoparmelia anzioides* (Darbishire, 1912) as *Anzia anzioides* (Darb.) Lamb. Under this name he reported the species from Argentina (Lamb, 1958) and Redón (1974) from Chile. Therefore the genus *Anzia* was included in the lichen flora of Argentina and Chile.

Since *Anzia* and *Pannoparmelia* are currently widely accepted as two different genera (Galloway, 1978; Eriksson, 1984; Eriksson & Hawksworth, 1993; Yoshimura, 1987; Adler & Calvelo, 1993; Elix, 1993), it is here considered that *Anzia anzioides* (Darb.) Lamb belongs to *Pannoparmelia anzioides* Darb. Therefore, there had been no real reports of *Anzia* species for southern South-America before the publication of *Anzia afromontana* for Chile (Santesson, 1986), afterwards confirmed for Chile (Galloway, 1992) and the present report for Argentina.

It is concluded that this is the first actual mention of *Anzia* s.str. for Argentina, and

that **Anzia afromontana** is the only species of the genus known from Argentina and Chile so far.

ACKNOWLEDGEMENTS

The author thanks R. Santesson for helpful discussion on the species concept and L. Tibell for his kind hospitality during the stay at UPS. Thanks are also due to A. Henssen (MB) and R. Moberg (UPS) for loan of material; M. Adler (BAFC) for determination of lichenic substances; G. Vobis, C. Ezcurra and I. Gamundí (BCRU) and M. Adler (BAFC) for critical reading to the manuscript. This work was financially supported by CONICET, Fundación Antorchas and the Secretaría de Investigación de la Universidad Nacional del Comahue.

REFERENCES

- Adler, M. & S. Calvelo. 1993. New reports on Parmeliaceae s.str. (Lichenized Ascomycotina) from Southwestern Argentina. *Mycotaxon* **46**: 105-127.
- Begon, M., J. Harper & C. Townsend. 1990. Ecology. Individuals, Populations and Communities. 2° Edition. Blackwell Scientific Publications. London.
- Calvelo, S. & M. Adler. 1992. **Pannoparmelia anzioides** a taxonomic synonym of **Pannoparmelia angustata** (Parmeliaceae, Lichenes). *Mycotaxon* **43**: 487-498.
- Calvelo, S. & M. Adler. 1994. **Menegazzia** (Ascomycotina, liquenizado) en la Argentina. *Bol. Soc. Argent. Bot.* **30** (1-2): 119-125.
- Calvelo, S. & L. Lorenzo. 1989. Noteworthy corticolous lichens in **Nothofagus** forests, North-Western Patagonia. *Mycotaxon* **34**(2): 655-665.
- Culberson, C. F. 1972. Improved conditions and new data for the identification of lichen

- products by standardized thin layer chromatographic method. *J.Chromatogr.* **72**: 113-125.
- Culberson, C.F. & K.Ammann. 1979. Standartmethode zur Dünnschichtchromatographie von Flechtensubstanzen. *Herzogia* **5**: 1-24.
- Darbishire, O. 1912. The lichens of the Swedish Antarctic expedition. In (Nordenskjöld, O. Ed.): *Wissenschaftliche Ergebnisse der Schwedischen Südpolar Expedition 1901-1903*: **4** (11). Nordstedt, Stockholm: 1-74.
- Elix, J. 1993. Progress in the generic delimitation of *Parmelia* sensu lato Lichens (Ascomycotina: Parmeliaceae) and a synoptic key to the Parmeliaceae. *The Bryologist* **96**(3): 359-383.
- Eriksson, O. 1984. *Systema Ascomycetum* 3. University of Umeå, Umeå.
- Eriksson, O. & D. Hawksworth. 1987. Notes on Ascomycetes Systematics. N° 464-551. *Systema Ascomycetum* **6**(2): 237-258.
- Eriksson, O. & D. Hawksworth. 1993. Outline of Ascomycetes. *Systema Ascomycetum* **12** (1-2): 51-257.
- Galloway, D. 1978. *Anzia* and *Pannoparmelia* (Lichens) in New Zealand. *Jour. Bot.* **16**: 261-270.
- Galloway, D. 1992. Lichens of "Laguna San Rafael", Southern Chile: indicators of environmental change. *Global Ecology and Biogeography Letters* **2**: 37-45.
- Hale, M. E. 1983. *The Biology of Lichens*. 3rd edition. Arnold. London.
- Henssen, A. & A.Dobelmann. 1987. Development of the spongiostrium in *Anzia* and *Pannoparmelia*. In: *Progress and Problems in Lichenology in the eighties*. *Bibl. Lichenol.* **25**: 103-108.
- Henssen, A., G. Keuck, B. Renner & G. Vobis. 1981. The Lecanoralean Centrum. In: D. Reynolds (ed.), *Ascomycetes Systematics, the Luttrellian Concept*. Springer, New York.
- Lamb, I.M. 1958. La vegetación líquénica de los Parques Nacionales Patagónicos. *Anales de Parques Nacionales*; VII. Buenos Aires.
- Müller Argoviensis, J. 1889. *Lichenologische Beiträge* XXXII. *Flora* **72**: 505-508.

- Poelt, J. 1973. Classification. Apendix A: 599-632. In: The Lichens, V. Ahmadjian & M. E. Hale (eds.). Academic Press, London and New York.
- Redón, J. 1974. Observaciones sistemáticas y ecológicas en líquenes del Parque Nacional Vicente Pérez Rosales. An. Mus. Hist. Nat. Valparaíso 7: 169-225.
- Santesson, R. 1986. In R. Moberg (ed.): Lichenes Selecti Exsiccati Upsaliensis. Thunbergia 2: 1.
- Stizenberger, E. 1861. **Anzia**, eine neue Flechtengattung. Flora 44: 390-393.
- Swinscow, T. & Krog, H. 1988. Macrolichens of East Africa. British Museum (Natural History). London.
- Yoshimura, I. 1987. Taxonomy and speciation of **Anzia** and **Pannoparmelia**. In: Progress and problems in Lichenology in the eighties. Bibl. Lichenol. 25: 185-195.
- Yoshimura, I. & A. Sharp. 1968. Some lichens from the Southern Appalachians and Mexico. The Bryologist 71: 108-113.
- Zahlbruckner, A. 1932. Catalogus Lichenum Universalis. Band VIII, Verlag von Gebrüder Borntraeger. Johnson Reprint Co. New York, 1951.

Notes on Korean Cercosporae and Allied Genera (II)

Hyeon-dong SHIN

Department of Horticulture, Kangnung National University,
Kangnung 210-702, South Korea

and

Uwe BRAUN

Martin-Luther Universität, Halle-Wittenberg, FB. Biologie,
Institut für Geobotanik und Botanischer Garten,
Neuwerk 21, Halle/S., D-06099, Germany

The present paper continues the investigations on Korean Cercosporae. Shin & Braun (1993) listed 40 species of this group of fungi including 4 new species, 2 new combinations and 23 new records for Korea. The species reported in the present paper were collected by H.D. Shin in Korea between 1990 and 1994. 40 species are listed, including 2 new species, 1 new variety, 2 new combinations, 1 new name and some new host records for Korea. The new species *Cercospora aristolochiae-contortae* and *Neoramularia koreana* are described and illustrated. Most species are new to the fungus flora of Korea.

All samples were collected by H.D. Shin, and the investigation of the material was carried out in collaboration between the two authors. Most of the common species are not described. They are usually well-described in some of the important reference books on Cercosporae. All specimens, including type collections, are deposited in the Herbarium (SMK) of the Department of Horticulture, Kangnung National University, Kangnung, Korea. Duplicates are housed in HAL.

(1) *Cercospora achyranthis* H. & P. Sydow, Annls Mycol. 7: 171 (1909)

On *Achyranthes japonica* (Miq.) Nakai, Chonju, Korea, 13 IX 1994, Shin. This is the first record of this species from Korea.

(2) *Cercospora* cf. *adusta* Heald & Wolf, Mycologia 3: 14 (1911)

Leaf spots scattered to confluent, distinct, large, usually 5-20 mm diam., circular, often zonate, grayish brown with a wide pale brown border line. Caespituli amphigenous, center on both leaf surfaces may be blackened by the heavy fructification of the fungus. Mycelium internal; hyphae septate, branched. Stromata slightly developed to nearly absent. Conidiophores 2-7 in a loose fascicle, uniformly pale olivaceous brown

throughout or paler upwards, 4-8-septate, several times slightly to abruptly geniculate at the upper part, not branched, 30-124 x 4.4-5.6 μm ; conidial scars large and conspicuously thickened. Conidia solitary, filiform to long, obclavate-cylindrical, mildly curved to substraight, pale or subhyaline, 3-13-septate, some septa obscure, not constricted at the septa, obtuse to subacute at the apex, subtruncate at the base, variable in length, 36-112 x 3.0-6.0 μm ; hilum large, thickened and darkened.

On *Ligustrum ovalifolium* Hassk., Chunchon, Korea, 29 X 1994, Shin.

Note: The taxonomy of *Cercospora* species on *Ligustrum* spp. is complicated. The present collection is somewhat different from North American material (cf. Chupp, 1954); the conidia are usually shorter (50-350 μm , Chupp, l.c.) and broader (1.5-3.5 μm , Chupp, l.c.) and pale to subhyaline in color (hyaline, according to Chupp, l.c.). This fungus is clearly different from *C. ligustri* (now *Pseudocercospora ligustri*) in many respects (cf. Deighton, 1976). Nevertheless, this Korean material is very close to *C. adusta*. This is the first record of this species from Korea.

(3) *Cercospora apii* Fresenius, Beitr. zur Mykol. 3: 91 (1863)

On *Apium graveolens* L., Pyongchang, Korea, 18 VIII 1993, Shin. Known from Korea (Nakata & Takimoto, 1928).

(4) *Cercospora arachidicola* Hori, Nishigahara Agric. Expt. Stat. Rept.: 26 (1917)

On *Arachis hypogaea* L., Yangku, Korea, 29 VIII 1993, Shin. Known from Korea (Park, 1967).

(5) *Cercospora arcti-ambrosiae* Halsted, in Seym. and Earle, Economic Fungi 296 & 297 (1893)

On *Arctium lappa* L., Chongju, Korea, 14 IX 1994, Shin. This is the first record of this species from Korea.

(6) *Cercospora aristolochiae-contortae* spec. nov.

Fig. 1.

Maculae amphigenae, angulares, saepe per venas limitatae, 1-7 mm diam., saepe confluentes, atrobrunneae, sine margine cinctae. Caespituli hypophylli. Mycelium immersum; hyphae septatae, ramosae. Stromata minuta, ex hyphis brunneis intertextis composita. Conidiophora fasciculata (3-12), divergentia, olivaceo-brunnea, interdum apicem versus pallidiora, levia, 4-9 septata, erecta, interdum 1-2 leniter geniculata, non ramosa, 160-340 x 4.0-5.6 μm . Cicatrices conidiales magnae, conspicuae, incrassatae, fuscatae. Conidia solitaria, filiformia vel acicularia, curvata vel undulata, hyalina, levia, 7-17 septata, non constricta, apice obtusa, basi truncata, 120-440 x 3.6-4.8 μm ; hila magna, incrassata, fuscata.

Leaf spots amphigenous, angular, vein-limited, 1-7 mm diam., but often confluent, dark brown, without definite margin. Caespituli hypophyllous. Mycelium internal; hyphae septate, branched. Stromata small, composed of brown hyphal aggregations. Conidiophores 3-12 in a divergent fascicle, uniformly olivaceous brown or paler upwards, smooth, 4-9-septate, straight but occasionally 1-2 times slightly geniculate, not branched, 160-340 x 4.0-5.6 μm ; conidial scars large and conspicuous,



Fig. 1. *Cercospora aristolochiae-contortae*: A, Leaf spots on *Aristolochia contorta*; B, Conidiophores; C, Conidia. H.D. Shin del.

thickened, darkened. Conidia solitary, filiform to acicular, curved to undulate, hyaline, smooth, 7-17-septate, not constricted at the septa, obtuse at the apex, truncate at the base, 120-440 x 3.6-4.8 μ m; hilum large and thickened, darkened.

Holotypus: On *Aristolochia contorta* Bunge (Aristolochiaceae), Chunchon, Korea, 20 IX 1994, Shin (SMK 13034).

Isotypus: HAL.

Note: *Cercospora olivascens* (type material compared!) is related to this fungus, but differs by shorter strongly and densely geniculate conidiophores. The conidia are shorter, obclavate-cylindrical, rarely acicular, base usually obconically truncate. Our new species possesses longer conidiophores, straight or only slightly geniculate, and the conidia are longer, filiform to acicular, base truncate, not or hardly attenuated.

- (7) *Cercospora* cf. *brassicicola* P. Henn., Bot. Jahrb. 37: 166 (1905)

On *Matthiola incana* R. Br., Kangnung, Korea, 27 X 1994, Shin.

Note: Taxonomy of *Cercospora* spp. on Brassicaceae is still unclear. There are numerous names, but the present fungus agrees well with *C. brassicicola*. The fungus is known on *Brassica napus* (Chung et al., 1977), but *M. incana* is a new host species for Korea.

- (8) *Cercospora cardamines* Losa, Anal. Jard. bot. Madrid 6: 453 (1945)

On *Cardamine amaraeformis* Nakai, Yangku, Korea, 2 X 1994, Shin. This is the first record of this species from Korea.

- (9) *Cercospora carotae* (Pass.) Solheim, Biol. Monogr. 12(1): 43 (1929)

On *Daucus carota* L., Myongju, Korea, 22 IX 1994, Shin. Known from Korea (Park, 1967).

- (10) *Cercospora chrysanthemi* Heald & Wolf, Mycologia 3: 15 (1911)

On *Chrysanthemum coronarium* var. *spatiosum* Bailey, Myongju, Korea, 6 XI 1994, Shin. Known from Korea (Park, 1967).

- (11) *Cercospora cichorii* J.J. Davis, Trans. Wis. Acad. Sci. Art. Lett. 19: 715 (1919)

On *Cichorium endivia* L., Suwon, Korea, 5 XI 1994, Shin. This is the first record of this species from Korea.

- (12) *Cercospora fukushiana* (Matsumura) Yamamoto, J. Plant Protect. 14: 699 (1927)

On *Impatiens balsamina* L., Chongju, Korea, 14 IX 1994, Shin. Known from Korea (Chung et al., 1977).

- (13) *Cercospora ludwigiae* Bagyanarayana, U. Braun & Jagadeeswar, Crypt. Bot. (1994), in press.

On *Ludwigia prostrata* Roxb., Myongju, Korea, 25 IX 1994, Shin. This is the first record of this species from Korea.

- (14) *Cercospora* cf. *nasturtii* Pass., Hedwigia 16: 124 (1877)

On *Arabis pendula* L., Jongsun, Korea, 1 VIII 1993, Shin.

Note: The collection agrees well with *C. nasturtii*; cf. note under *C.*

brassicicola. This is the first record of this species from Korea.

- (15) *Cercospora sesami* Zimmerman, Ber. Land.-Forst. Deutsch.-Ostafr. 2: 28 (1904)

On *Sesamum indicum* L., Kangnung, Korea, 16 VII 1990, Shin.
Known from Korea (Nakata & Takimoto, 1928).

- (16) *Cercospora subhyalina* H.D. Shin & U. Braun, in Braun, A monograph of *Cercospora*, *Ramularia* and allied genera (Phytopathogenic hyphomycetes), Vol. 1 (1995), in press.

On leaves of *Brachybotrys paridiformis* Maxim., Pyongchang, Korea, 2 VII 1994, Shin. Known from Korea (Braun, 1995b).

- (17) *Cercospora virgaureae* (Thüm.) Allescher, Hedwigia 34: 286 (1895)

On *Erigeron annuus* (L.) Pers., Myongju, Korea, 8 XI 1994, Shin.
This is the first record of this species from Korea.

- (18) *Mycovellosiella ferruginea* (Fuckel) Deighton, Mycol. Pap. 144: 14 (1979)

On *Artemisia argyi* Lév. & Vnt., Yangku, Korea, 2 X 1994, Shin.
On *Artemisia feddei* Lév. & Vnt., Yangku, Korea, 2 X 1994, Shin. This is the first record of this species from Korea.

- (19) *Neoramularia koreana* sp. nov.

Fig. 2.

Maculae amphigenae, suborbiculares vel irregulares, 2-5 mm diam., primo minutae, purpureo-brunneae, decenter flavido-brunneae, margine atropurpureo cinctae, plerumque non confluentes. Caespituli amphigeni. Mycelium immersum; hyphae hyalinae, septatae, ramosae. Stromata nulla. Conidiophora solitaria vel laxae aggregata, per cuticulam erumpentia, raro per stoma emergentia, hyalina, levia, non septata, erecta, 16-32 x ca. 2 μ m. Cicatrices conidiales minutae, inconspicuae, non incrassatae, hyalinae. Conidia solitaria vel breviter catenata, cylindrica, hyalina, levia, 0-1 septata, non constricta, apice et basi leniter attenuata, 14-32 x 2.0-2.8 μ m, hila inconspicua, non incrassata, hyalina.

Leaf spots amphigenous, subcircular to irregular, 2-5 mm diam., at first forming small purplish brown spots, later center becoming yellowish brown with dark purplish margin, usually not confluent. Caespituli amphigenous. Mycelium internal; hyphae hyaline, septate, branched. Stromata absent. Conidiophores solitary or occasionally in small loose groups, erumpent through the cuticle, rarely through stomata, hyaline, smooth, aseptate, straight, 16-32 x ca. 2 μ m; conidial scars small, inconspicuous, unthickened, not darkened, colorless. Conidia solitary or in short unbranched chains, cylindrical, hyaline, smooth, 0-1-septate, not constricted at the septa, pointed at both ends, 14-32 x 2.0-2.8 μ m; hilum inconspicuous, unthickened, colorless.

Holotypus: On leaves of *Stachys riederi* var. *japonica* Miq. (Labiatae), Myongju, Korea, 22 IX 1994, Shin (SMK 13053).

Isotypus: HAL.

Note: This fungus is *Ramularia*-like, but differs by unthickened,

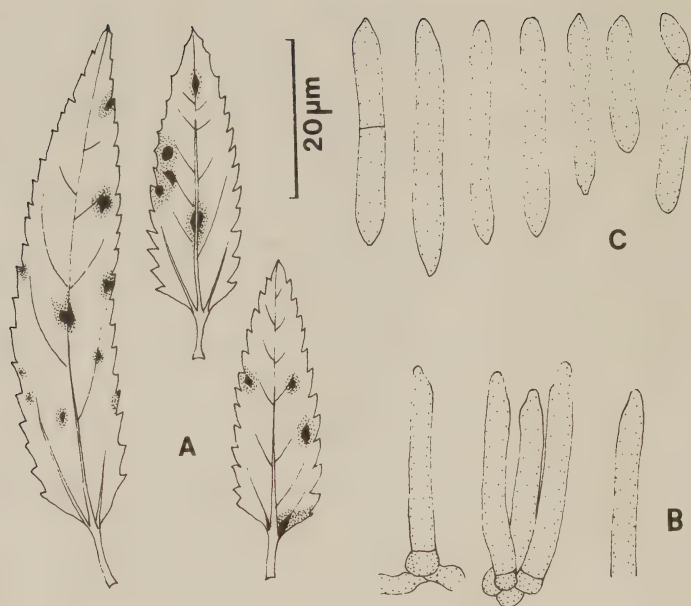


Fig. 2. *Neoramularia koreana*: A, Leaf spots on *Stachys riederi* var. *japonica*; B, Conidiophores; C, Conidia. H.D. Shin del.

inconspicuous conidial scars and hila. Braun (1991) introduced the genus *Neoramularia* for *Ramularia*-like species with unthickened, inconspicuous conidial scars. There is no comparable *Neoramularia* species. Therefore, this fungus must be considered as new, undescribed species.

(20) *Passalora amurensis* (Zilling) comb. nov.

Bas.: *Cercospora amurensis* Zilling, Acta Inst. Acad. Sci. U.R.S.S. II (Pl. Crypt.) 3: 696 (1936).

On *Syringa reticulata* var. *mandshurica* (Maxim.) Hara, Jongsun, Korea, 1 VIII 1993, Shin.

Note: The conidial scars and hila are almost unthickened, but not inconspicuous. They are somewhat darkened, to be seen as minute, somewhat darkened rings. This is clearly the *Passalora* type of scars (Braun, 1995a). Therefore, *C. amurensis* must be transferred to the latter genus. This is the first record of this fungus from Korea.

(21) *Passalora depressa* (Berk. & Broome) Sacc., N. Giorn. bot. Ital. 8: 187 (1876)

On *Angelica gigas* Nakai, Suwon, Korea, 20 VIII 1993, Shin. This is the first record of this species from Korea.

(22) *Passalora soja* (Hara) comb. nov.

Bas.: *Cercospora soja* Hara, Nogyo Sekai, Tokyo 9: 28 (1915).

Syn.: *Cercosporidium sojinum* (Hara) Liu & Guo, Acta Mycol. Sinica 1(2): 100 (1982).

On *Glycine soja* Sieb. & Zucc., Kangnung, Korea, 24 VI 1993, Shin.

Note: The conidia are rather wide, cylindric-obclavate and the conidial scars belong to the *Passalora* type. *Cercosporidium* is synonymous with *Passalora* (Braun, 1995a). This fungus was recorded as *C. soja* on *Glycine max* (Park, 1967), but *G. soja* is a new host species for Korea.

(23) *Phaeoramularia weigelicola* U. Braun & H.D. Shin, nom. nov.

Bas.: *Ramularia weigeliae* Speg., Michelia 1: 475 (1879),

non *Phaeoramularia weigeliae* Guo & Liu, in Guo, Acta Mycol. Sinica, Suppl. 1: 342-343 (1986).

Leaf spots scattered, distinct, angular to irregular, sometimes vein-limited, 2-5 mm diam., light brown center with dark purplish brown margin. Caespituli hypopyllous. Mycelium internal; hyphae hyaline, septate, branched. Stromata small, substomatal, composed of several swollen brown hyphae, forming aggregations. Conidiophores 2-6 in a loose divergent fascicle, pale olivaceous brown at the base, paler upwards, subhyaline to hyaline at the apex, 0-2-septate, substraight, not branched, 32-76 x 2.4-3.4 μm ; conidial scars small, conspicuously thickened, somewhat darkened. Conidia solitary or catenate, in unbranched or branched chains, cylindrical to ellipsoid, straight, hyaline, 0-1-septate, not constricted at the septa, broadly rounded or shortly obconic at both ends, 6-24 x 2.4-3.6 μm ; hilum small, somewhat thickened and darkened.

On *Weigela florida* (Bunge) A. DC., Chunchon, Korea, 20 IX 1994, Shin.

Note: This fungus is close to or identical with *Ramularia weigeliae*. Type material is unfortunately not preserved. The conidiophores are pigmented almost throughout. Therefore, this species should be placed in *Phaeoramularia*, but the epitheton cannot be transferred because of the name *Phaeoramularia weigeliae* (*weigeliae* and *weigela* are confusable, according to the ICBN). Therefore, a new name must be introduced. *Phaeoramularia weigeliae* Guo & Liu is distinct (conidiophores longer and wider, brown; conidia longer and above all wider, 4-7.5 μm , and 1-3-septate).

(24) *Pseudocercospora araliae* (P. Henn.) Deighton, Mycol. Pap. 140: 19 (1976)

On *Aralia elata* Seem., Myongju, Korea, 28 IX 1994, Shin. This is the first record of this species from Korea.

(25) *Pseudocercospora cannabina* (Wakef.) Deighton, Mycol. Pap. 140: 141 (1976)

On *Cannabis sativa* L., Suwon, Korea, 12 IX 1994, Shin. Known from Korea (Park, 1967, sub *Cercospora cannabis*).

(26) *Pseudocercospora cantuariensis* (Salmon & Wormald) U. Braun, Mycotaxon 48: 281 (1993)

On *Humulus japonicus* Sieb. & Zucc., Myongju, Korea, 18 X 1994, Shin. This is the first record of this species from Korea.

- (27) *Pseudocercospora chengtuensis* (Tai) Deighton, Mycol. Pap. 140: 141 (1992)

On *Lycium chinense* Mill., Taejon, Korea, 14 IX 1994, Shin. This is the first record of this species from Korea.

- (28) *Pseudocercospora cydoniae* (Ell. & Everh.) Guo & Liu, Mycosystema 5: 103 (1992)

On *Chaenomeles sinensis* Koehne, Myongju, Korea, 8 XI 1994, Shin. This fungus was recorded on *C. lagenaria* (Shin & Braun, 1993), but *C. sinensis* is a new host species for Korea.

- (29) *Pseudocercospora fukuokaensis* (Chupp) Liu & Guo, Mycosystema 5: 103 (1992)

On *Styrax japonica* Sieb. & Zucc., Chonju, Korea, 13 IX 1994, Shin. This is the first record of this species from Korea.

- (30) *Pseudocercospora nojimai* (Togashi & Katsuki) Guo & Liu, Mycosystema 5: 105 (1992)

On *Impatiens textori* Miq., Chunchon, Korea, 20 IX 1994, Shin. This is the first record of this species from Korea.

- (31) *Pseudocercospora puderi* Deighton, Mycol. Pap. 140: 90 (1976)

On *Rosa multiflora* Thunb., Chonju, Korea, 13 IX 1994, Shin. This is the first record of this species from Korea.

- (32) *Pseudocercospora rubi* (Sacc.) Deighton var. *subhyalina* var. nov.

Caespituli amphigeni, saepe hypophylli. Conidiophora ca. 12-26 x 4 μ m, subhyalina. Conidia filiformia, ad apicem rotundata, basi rotundata vel subtruncata.

Leaf spots scattered, distinct, circular to subcircular, zonate, 3-10 (-15) mm diam., brown to reddish brown with purplish brown margin. Caespituli amphigenous, but often hypophyllous. Mycelium internal; hyphae septate, branched. Stromata large, well-developed, globular, sub-stomatal. Conidiophores ca. 10-30 in a dense fascicle, pale or subhyaline, 0-1-septate, not branched, substraight to mildly sinuous, not geniculate, 12-26 x ca. 4.0 μ m; conidial scars inconspicuous. Conidia solitary, filiform, straight to mildly curved, subhyaline to pale greenish, 6-16-septate, septation intervals uneven, some septa obscure, not constricted at the septa, rounded at the apex, subtruncate at the base, 56-132 x 2.8-4.0 μ m.

Holotypus: On leaves of *Rubus oldhamii* Miq. (Rosaceae), Tonghae, Korea, 12 XI 1994, Shin (SMK 13388).

Isotypus: HAL.

Note: The Korean collection is somewhat different from North American material (cf. Chupp, 1954): Fructification chiefly epiphyllous; conidiophores sometimes branched and longer (10-40 μ m), and conidial

scars minute. The Korean material also differs from European material by short subhyaline conidiophores and by conidia with usually rounded or only subtruncate base and obtuse apex (conidiophores in var. *rubi* pigmented, conidia usually with obconically truncate base and subacute apex).

- (33) *Pseudocercospora capsellae* (Ell. & Everh.) Deighton, Mycol. Pap. 133: 42 (1973)
On *Capsella bursa-pastoris* (L.) Medicus, Myongju, Korea, 19 V 1993, Shin. This fungus was recorded on *Brassica* spp. (Shin & Braun, 1993), but *C. bursa-pastoris* is a new host species for Korea.
- (34) *Pseudocercospora inconspicua* (G. Winter) U. Braun, Nova Hedwigia 47: 343 (1988)
On *Lilium distichum* Nakai, Pyongchang, Korea, 21 VI 1994, Shin. This is the first record of this species from Korea.
- (35) *Ramularia armoraciae* Fuckel, Jahrb. Nass. Ver. Naturk. 23-24: 361 (1870), emend. U. Braun (1995b)
On *Barbarea orthoceras* Ledeb., Myongju, Korea, 19 V 1993, Shin. This is the first record of this species from Korea.
- (36) *Ramularia archangelicae* Lindr., Acta Soc. Fauna Fl. Fenn. 23(3): 22 (1902)
On *Angelica anomala* Lallemant, Pyongchang, Korea, 10 VIII 1992, Shin. On *Angelica dahurica* (Fisch.) Benth. & Hooker f., Yangku, Korea, 2 X 1994, Shin. This is the first record of this species from Korea.
- (37) *Ramularia cynarae* Sacc., Michelia 1: 536 (1879), emend. U. Braun (1995b)
On *Carduus crispus* L., Jongsun, Korea, 26 VI 1994, Shin. On *Echinops latifolius* Tausch., Pyongchang, Korea, 5 IX 1993, Shin. This is the first record of this species from Korea.
- (38) *Ramularia plantaginis* Ell. & Mart., Am. Nat. 16: 1003 (1882)
On *Plantago asiatica* L., Chunchon, Korea, 28 V 1994, Shin. This is the first record of this species from Korea.
- (39) *Ramularia pratensis* Sacc., Fung. Ital. Tab. 998 (1881)
On *Rumex acetosa* L., Kangnung, Korea, 8 VI 1994, Shin. On *Rumex crispus* L., Pyongchang, Korea, 26 VI 1993, Shin. This is the first record of this species from Korea.
- (40) *Ramularia rubella* (Bon.) Nannf., in Lundell & Nannf., Fungi Exs. Suec. fasc. XXXIV-XL, Sched., p. 33 (1950)
On *Rumex crispus* L., Samchok, Korea, 1 XI 1994, Shin. This fungus was recorded on *R. longifolius* (Shin & Braun, 1993), but *R. crispus* is a new host species for Korea.

ACKNOWLEDGMENTS

This study was partly supported by the Korea Science & Engineering Foundation (Grant No. 941-0600-043-2). Prof. Y.R. Chung, Gyeongsang National University, Korea, kindly reviewed the manuscript.

REFERENCES

- Braun, U. (1991): Studies on *Ramularia* and allied genera (IV). *Nova Hedwigia* 53(3-4): 291-305.
- Braun, U. (1992): Studies on *Ramularia* and allied genera (V). *Nova Hedwigia* 54(3-4): 459-478.
- Braun, U. (1995a): Miscellaneous notes on phytopathogenic hyphomycetes (II). *Mycotaxon* 55: 223-241.
- Braun, U. (1995b): A Monograph of *Cercosporella*, *Ramularia* and allied genera (Phytopathogenic Hyphomycetes), Vol. 1 and 2, in press.
- Braun, U., Bagyanarayana, G. and Jagadeeswar, P. (1994): Notes on Indian *Cercosporae* and allied genera (IV). *Crypt. Bot.*, in press.
- Chung, B.J., Lee, Y.H. and Lee, E.K. (1977): Survey of plant diseases in major crops in Korea. Research Rept. Plant Prot. Train. Proj. 7: 3-28.
- Chupp, C. (1954): A Monograph of the Fungus Genus *Cercospora*. Ithaca, New York, 667 pp.
- Deighton, F.C. (1976): Studies on *Cercospora* and Allied Genera. VI. *Pseudocercospora* Speg., *Pantospora* Cif. and *Cercoseptoria* Petr. *Mycol. Papers* 140: 1-168.
- Guo, Y.L. and Liu, X.J. (1992): Studies on the genus *Pseudocercospora* in China VI. *Mycosystema* 5: 99-108.
- Nakata, K. and Takimoto, K. (1928): List of diseases of cultivated plants in Korea. *Bull. agric. Exp. Stat. Korea* 15: 1-146. (in Japanese).
- Park, J.S. (1967): Fungous diseases of plants in Korea. *Bull. Chungnam Nat. Univ.* 6: 1-86.
- Shin, H.D. and Braun, U. (1993): Notes on Korean *Cercosporae* and allied genera (I). *Mycotaxon* 49: 351-362.

MYCOTAXON

Volume LVIII, pp. 167-183

April-June 1996

NEW USTILAGINALES ON CYPERACEAE FROM AUSTRALIA.

KÁLMÁN VÁNKY

Universität Tübingen, Botanisches Institut, Spezielle Botanik und Mykologie.

Auf der Morgenstelle 1, D-72076 Tübingen, Germany

&

KIRSTEN A. WEBSDANE

University of Western Australia, Faculty of Agriculture,

Dept. of Soil Science and Plant Nutrition.

Nedlands, W.A. 6009, Australia

ABSTRACT

Six new Tolyposporium species are described on members of Cyperaceae from Australia: T. mesomelaenae Websdane & K. Vánky (type on Mesomelaena pseudostygia (Kük.) K. L. Wilson), T. melanosporum Websdane & K. Vánky (type on Mesomelaena graciliceps (C. B. Clarke) K. L. Wilson), T. evandrae Websdane & K. Vánky (type on Evandra aristata R. Br.), T. caustidis K. Vánky (type on Caustis blakei Kük.), T. tricoetariae Websdane & K. Vánky (type on Tricoetaria neesii Lehm.), and T. cyathochaetae Websdane & K. Vánky (holotype on Cyathochaeta avenacea Benth., paratype on C. clandestina (R. Br.) Benth.). A further Tolyposporium on Mesomelaena stygia (R. Br.) Nees, with a great variability and irregularity of the spores and spore balls, is also presented. The possible causes of the occurrence of anomalous spores and spore balls between "regular" spore balls, observed in some other Tolyposporium too (though in small percentage), are discussed. A key to the 18 known Tolyposporium species on Cyperaceae is given.

INTRODUCTION

"Australia's fungal flora has been poorly researched and documented to date. At a time when the importance of biodiversity is being recognised, the fungi stand out as one of the most poorly known groups of organisms. It has been estimated that there are over 250 000 species of fungi in Australia of which we probably know fewer than five per cent" (Pascoe apud Kile & Grgurinovic, 1995:29). The ca. 130 species of Ustilaginales, known from Australia, probably also represent only a small part of the existing species.



Fig. 1. *Tolyposporium mesomelaenae* Websdane & K. Vánky on *Mesomelaena pseudostygia* (Kük.) K. L. Wilson (type). **A.** Habit. **B.** Healthy spikelet. **C.** Infected spikelet. **D.** Infected spikelet with most of the glumes removed. **E.** Internal floral parts covered with agglutinated mass of spore balls.

(Bars = 1 cm and 2 mm respectively)

For microscopical studies dried specimens were used. Light microscope (LM) with an oil immersion lens, at a magnification of 1000 x was used for studies of spore morphology and measurements. For this purpose dried spores were soaked in lactophenol by gentle heating to the boiling point. Black spore balls were bleached in concentrated hydrogen peroxide for 10–30 minutes to permit examination of the spore ball structure, the shape of the spores and counting of the spores in the balls. Because the treatment of the spores with hydrogen peroxide swells up the walls, no measurements were done on such bleached spores. For studies of the sorus structure and spore ball formation, 0.5 µm thick sections of young sori embedded in plastic were prepared by the standard technique for TEM preparations, and stained with new fuchsin – crystal violet. For scanning electronmicroscopical (SEM) studies, dried spores were dusted on small pieces of double-sided adhesive tape and sputter-coated with gold-palladium, ca. 20 nm.

RESULTS AND DISCUSSION

Studies of smutted Cyperaceae from South and Western Australia resulted in the recognition of several unknown Ustilaginales belonging to the genus Tolyposporium, of which some are described in this paper.

The genus Tolyposporium Woronin ex Schröter, 1887:276 (type: T. junci (Schröter) Woronin ex Schröter on Juncus bufonius L.), is characterised by mainly "external" (not within the host tissues) sori in floral parts, flowers or on vegetative parts of the host plant, forming agglutinated or granular-powdery, black masses of spore balls. Spore balls are composed of few to many, firmly agglutinated, dark-coloured spores. There are no sterile cells in the balls or between them. Spore germination is of Ustilago-type. Known species ca. 20, on Cyperaceae, Juncaceae and ?Restionaceae (comp. Vánky, 1987:116).

The genus Mesomelaena Nees (Cyperaceae) consists of five species endemic to the south-west of Western Australia (Wilson, 1981). Smut fungi have been found on three of these species, namely, M. pseudostygia (Kük.) K. L. Wilson, M. graciliceps (C. B. Clarke) K. L. Wilson, and M. stygia (R. Br.) Nees. On the first two species two undescribed Tolyposporium species could be identified. On the third species a Tolyposporium was found which is interpreted as a hybrid between the smut of M. graciliceps and an unknown smut fungus.

Tolyposporium mesomelaenae Websdane & K. Vánky, sp. nov.

Typus in matrice Mesomelaena pseudostygia (Kük.) K. L. Wilson, Australia, Western Australia, Carnamath Distr., prope oppid. Eneabba, 29°49'46" S, 115°15'54" E, 3.XII.1992, leg. K. Websdane. Holotypus in Herbario Ustil. Vánky (HUV 17004!), isotypus in PERTH.

Sori (Fig. 1) in floribus, partibus integumentis florum perfecte obtecti. Infectio systemica. Spiculae infectae parum tumefactae pallidioresque illis inflorescentiarum salvarum. Fungus noster organa interna florum deformans et plus-minus destruens illa massa nigra glomerulorum sporarum primo agglutinata, deinde granuloso-pulverea obtogens. Glomeruli sporarum (Figg. 2, 3, 4) secundum multitudinem sporarum valde diversam pro glomerulis forma et magnitudine variabiles, globosi, subglobosi, ellipsoidales, elongati vel irregulares, 20–50(–60) x 25–70(–80) µm, obscure, atro-rufobrunnei, e sporis (3–)10–40(–80 vel plus ?) firmiter unitus compositi. Sporae (Figg. 2, 3, 4) in latere unico vel pluribus lateribus deplanatae, superficie libera parum convexa usque hemisphaerica, irregulariter polygonali, 8–12,5 x 9,5–15(–18) µm, visu mediano subcuneiformes, parum elongatae vel irregulares, 6,5–15(–20) µm longae, pallide usque

mediocriter rufobrunneae; pariete superficiei liberae crasso (2–5 μm), irregulariter verruculoso, pariete superficiei tangentialis tenuiores (0,5–1,5 μm), leves.

Sori (Fig. 1) in the flowers, completely hidden by the floral envelopes. Infection systemic. Infected spikelets slightly swollen and lighter than those of healthy inflorescences. The fungus deforms and more or less destroys the internal floral organs, which are covered by the first agglutinated, later granular-powdery, black mass of spore balls. Spore balls (Figs. 2, 3, 4) variable in shape and size due to the large variation in spore numbers per spore ball, globose, subglobose, ellipsoidal, elongated or irregular, 20–50(–60) $\times$ 25–70(–80) μm , dull, dark reddish-brown, composed of (3–)10–40(–80 or more ?) firmly united spores. Spores (Figs. 2, 3, 4) flattened at one or several sides, with slightly convex to hemispherical, irregularly polygonal free surface, 8–12.5 $\times$ 9.5–15(–18) μm , in median view subcuneiform, slightly elongated or irregular, 6.5–15(–20) μm long, light to medium reddish-brown; wall of the free surface thick (2–5 μm), irregularly verruculose, wall of contact sides thinner (0.5–1.5 μm), smooth.

Tolyposporium melanosporum Websdane & K. Vánky, **sp. nov.**

Typus in matrice Mesomelaena graciliceps (C. B. Clarke) K. L. Wilson, Australia, Western Australia, Jerramungup Distr., Fitzgerald River National Park, 6.5 km. of Quaalup homestead, 34°15' S, 119°23'23" E, alt. ca. 30 m, 6.III.1993, leg. K. Websdane. Holotypus in Herbario Ustil. Vánky (HUV 17077!), isotypus in PERTH.

Sori (Fig. 7) in floribus, bracteis et glumis perfecte obtecti. Flores infectae illis inflorescentiarum sanarum conspicue similes. Massa nigra, granuloso-pulverea glomerulorum sporarum organa floralia interna destructa circumdans. Glomeruli sporarum (Figg. 5, 6, 8, 9) subglobosi, ovoidei usque elongati vel irregulares, 30–70 $\times$ 40–110 μm , atro-nigrobrunnei usque nigri, opaci, e multitudine (40–140 vel plus) sporarum firmiter unitarum compositi. Sporae (Figg. 8, 9) visu mediano breviter usque longe subcuneiformes vel elongatae, 8–22 μm longae, rufobrunneae usque nigrobrunneae, visu superficiali irregulariter polygonales, 6.5–10 $\times$ 7–12 μm ; paries superficiei liberae crassus (2–4 μm), irregulariter verrucosus, paries laterum tangentialium tenuis (cca. 0,5 μm) et levis, sed ad basin versus crassior.

Sori (Fig. 7) in the flowers completely hidden by the involucre bracts and glumes. Infected flowers appear identical to those of healthy inflorescences. The black, granular-powdery mass of spore balls surrounds the destroyed internal floral organs. Spore balls (Figs. 5, 6, 8, 9) subglobose, ovoid to elongated or irregular, 30–70 $\times$ 40–110 μm , dark blackish-brown to black, opaque, composed of a great number (40–140 or more) firmly united spores. Spores (Figs. 8, 9) in median view short to long subcuneiform or elongated, 8–22 μm long, reddish- to blackish-brown, in surface view the spores are irregularly polygonal, 6.5–10 $\times$ 7–12 μm ; wall of the free surface thick (2–4 μm), irregularly verrucose, wall of the contact sides thin (ca. 0.5 μm) and smooth, but thicker again at the base.

Larger, darker spore balls and a larger number of spores per spore ball distinguish T. melanosporum from T. mesomelaenae.

Figs. 2–4. Tolyposporium mesomelaenae Websdane & K. Vánky on Mesomelaena pseudostygia (Kük.) K. L. Wilson (type).

Fig. 2. Transversal section of a part of a sorus with spore balls being formed on the surface of host tissue.

Figs. 3, 4. Spore balls in LM and in SEM.

Figs. 5, 6. Tolyposporium melanosporum Websdane & K. Vánky on Mesomelaena graciliceps (C. B. Clarke) K. L. Wilson (type). Spore balls in LM and in SEM.
(Bars = 10 μm)

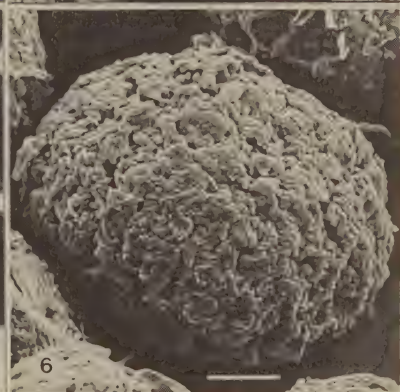
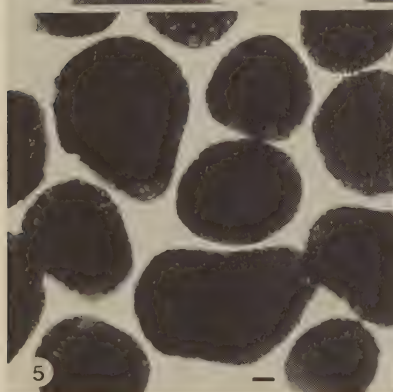
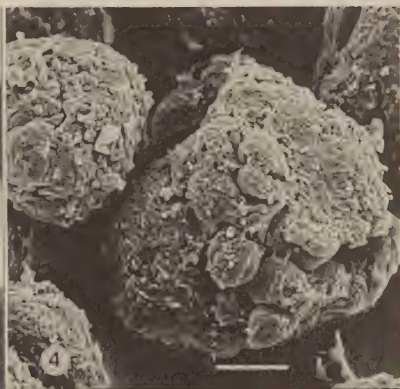
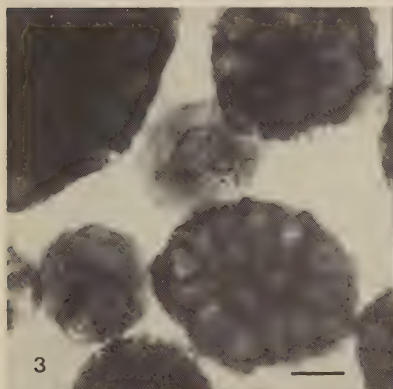
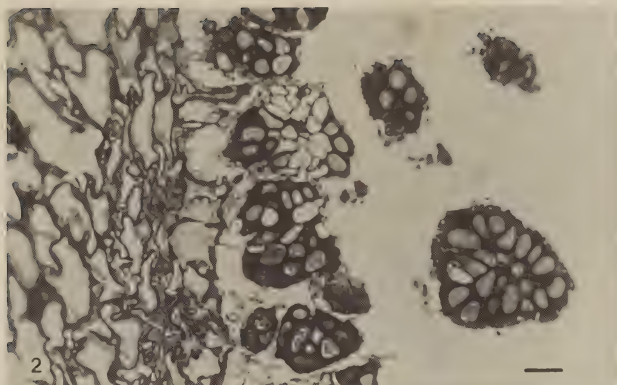




Fig. 7. Tolyposporium melanosporum Websdane & K. Vánky on Mesomelaena graciliceps (C. B. Clarke) K. L. Wilson (type). Habit. (Bar = 1 cm)

Figs. 8, 9. Tolyposporium melanosporum Websdane & K. Vánky on Mesomelaena graciliceps (C. B. Clarke) K. L. Wilson (type). Not fully mature spore balls in LM seen in optical median view and in surface view.

Figs. 10, 11. Tolyposporium (hybrid) on Mesomelaena stygia (R. Br.) Nees. Spore balls with different kinds of spores in LM and in SEM.

Figs. 12, 13. Tolyposporium evandrae Websdane & K. Vánky on Evandra aristata R. Br. (type). Fig. 12. Spore balls in LM. Fig. 13. Transversal section of a spore ball in LM (stained). (Bars = 10 μ m)

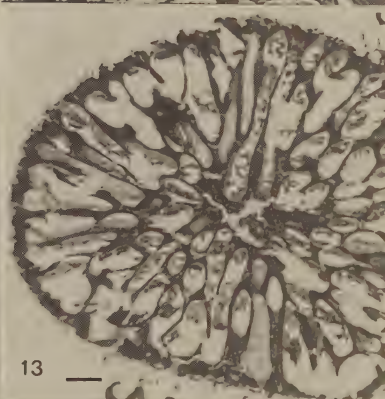
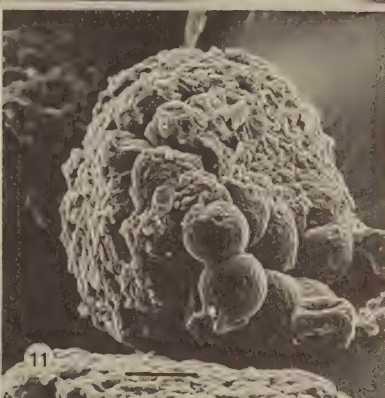
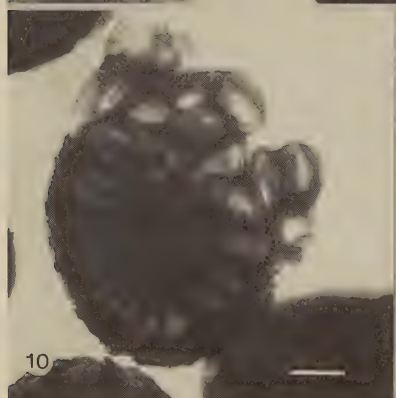




Fig. 14. *Tolyposporium melanosporum* or a hybrid of it on *Mesomelaena stygia* (R. Br.) Nees. **A.** Habit. **B.** Infected spikelet looking like a healthy one. **C.** A dissected spikelet with the uppermost flower showing two of the three, more or less aborted anthers and the nut filled with the black mass of spore balls.
(Bars = 1 cm and 2 mm respectively)

A further Tolyposporium was collected by the junior author on Mesomelaena stygia (R. Br.) Nees, Australia, Western Australia, Jerramungup Distr., Fitzgerald River National Park, ca. 6.5 km. of Quaalup homestead, 34°15' S, 119°23'23" E, alt. ca. 30 m, 6.III.1993, K. Websdane (HUV 170051, PERTH).

Sori (Fig. 14) in the nuts and around internal floral organs as black, semiagglutinated or granular-powdery mass of spore balls completely hidden by the glumes, evident only after dissection of the spikelets. Infection systemic; all inflorescences of a plant and all spikelets of an inflorescence being affected. Spore balls (Figs. 10, 11) variable, subglobose, ovoid, elongated or irregular, 30–70(–80) × 35–100(–150) µm, blackish-brown, opaque, composed of tens to one hundred or more firmly united subcuneiform spores. A certain percentage of the spore balls is quite different from the regular balls in possessing loosely arranged, globoid, ellipsoidal, lemon-shaped or obovoid spores often with a narrow, pedicel-like part toward the centre of the spore balls. In some spore balls both kinds of spores are visible or half of a ball is regular, the other half is irregular. In other cases such hemiglobose spores may be single or they are attached to the surface of "regular" spore balls. Spore balls from different sori may show anomalous balls in different percentage. Spores from "regular" balls are cuneiform or subcuneiform, 9–25 µm long, the free surface is polygonal, 7–11.5 × 9.5–15 µm, dull-brown; wall of free surface 1.5–5 µm thick, irregularly verrucose, contact walls thin (0.5–1.5 µm), smooth. Spores from irregular balls have unevenly thickened, 1.5–8 µm wide, smooth to finely verruculose wall.

Based on the "regular" spore balls and spores, this collection may belong to Tolyposporium melanosporum (opus ipsum). The place of collection of these two smuts is also identical. However, because of the irregularity and variability of the spore balls and spores, this collection could also represent a hybrid (between T. melanosporum and an unknown smut). Hybrid smut fungi are not uncommon in nature and were also obtained under laboratory conditions between rather widely different species (comp. chapter Hybridization, mutation, and genetics, Fischer & Holton, 1957:293–330). Another interpretation of the occurrence of loosely connected, globoid spores would be that external factor/s are disturbing the spore ball building and a spore, a group of spores or part of a spore ball escape from the coherence and mutual pressure of other spores.

Tolyposporium evandrae Websdane & K. Vánky, sp. nov.

Typus in matrice Evandra aristata R. Br., Australia, Western Australia, Albany Distr., ca. 35 km NE. urbe Albany, Betty's Beach, 34°56'18" S, 118°11'15" E, alt. ca. 10 m, 6.III.1993, leg. I. Sieler. Holotypus in Herbario Ustil. Vánky (HUV 17022!), isotypus in PERTH.

Sori (Fig. 15) in floribus, integumentis floralibus perfecte obtecti. Spiculae infectae ovoideae, parum tumefactae et clausae manentes. Fungus noster organa floralia interna deformans et plus-minus destruens, illa massa nigra glomerulorum sporarum primo agglutinata deinde granuloso-pulverea obtgens. Infectio systemica, spiculae omnes eiusdem inflorescentiae infectae. Glomeruli sporarum (Figg. 12, 13) subglobosi, ellipsoideales usque elongati vel irregulares, 80–140(–160) × 90–160(–210) µm, nigri, opaci, e sporis valde copiosis (pluries centum), firmiter unitis, compressione magis diffractis quam dissolutis compositi. Sporae (Figg. 16, 17) visu mediano subcuneiformes usque elongatae, subcylindricae, 5–14 × 20–40 µm, atro-chocolatabrunneae; superficies libera earum polygonaliter irregularis, 5,5–12 × 6,5–14 µm; paries superficiei liberae irregulariter asper, crassus (2,5–5 µm), cum poro germinationis centrali, paries laterum tangentialium levis, tenuis (cca. 0,5 µm). Versus centrum glomerulorum sporarum majorum partes parietis sporarum possibiliter etiam liberae, et hae partes parietum incrassatae et asperae.

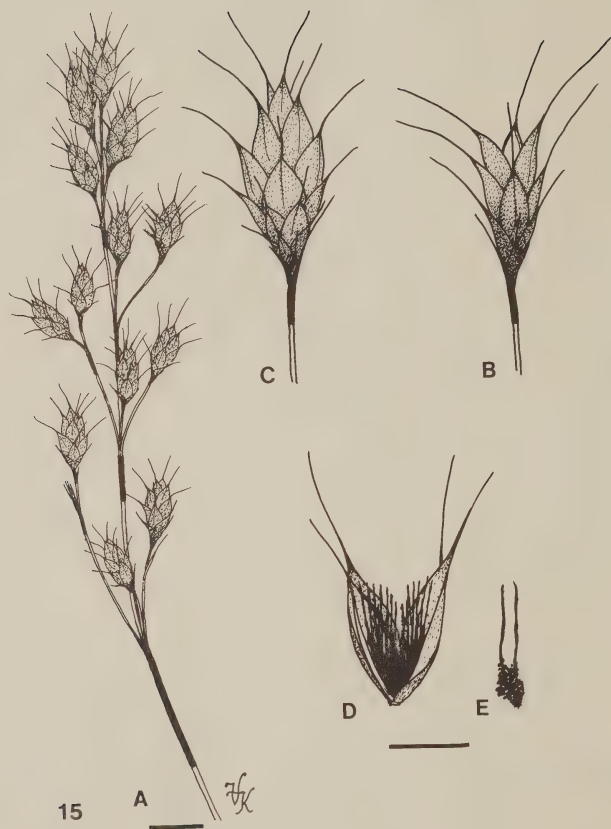


Fig. 15. *Tolyposporium evandrae* Websdane & K. Vánky on *Evandra aristata* R. Br. (type). **A.** Habit. **B.** Healthy spikelet. **C.** Infected spikelet. **D.** Infected spikelet with most of the glumes removed. **E.** Filamentous, internal floral parts with agglutinated mass of spore balls at their basal part.

(Bars = 1 cm and 5 mm respectively)

Sori (Fig. 15) in the flowers, completely hidden by the floral envelopes. Infected spikelets ovoid, slightly swollen and remaining closed. The fungus deforms and more or less destroys the internal floral organs, which are covered by the first agglutinated, later granular-powdery, black mass of spore balls. Infection systemic, all spikelets of an inflorescence being affected. Spore balls (Figs. 12, 13) subglobose, ellipsoidal to elongated or irregular, 80–140(–160) x 90–160(–210) μm , black, opaque, composed of a very great number (hundreds) of firmly united spores which break rather than separate at pressure. Spores (Figs. 16, 17) in median view subcuneiform to elongated, subcylindrical, 5–14 x 20–40 μm , dark chocolate-brown; free surface polygonally irregular, 5.5–12 x 6.5–14 μm ; wall of the free surface irregularly rough, thick (2.5–5 μm), with a central germ pore, wall of the contact sides smooth, thin (ca. 0.5 μm). Toward the centre of large spore balls part of the spore walls may also be free and that part of the spore wall is thickened and rough.

The morphological study of the dark spore walls and strongly agglutinated, opaque spores in LM is very difficult. After treating the spore balls with conc. hydrogen peroxide for 15–30 minutes, the spores become lighter and separate easily. However, one should not forget that spores, especially the spore walls, treated in such a way swell considerably. The spore and spore wall measurements given above refer to untreated spores.

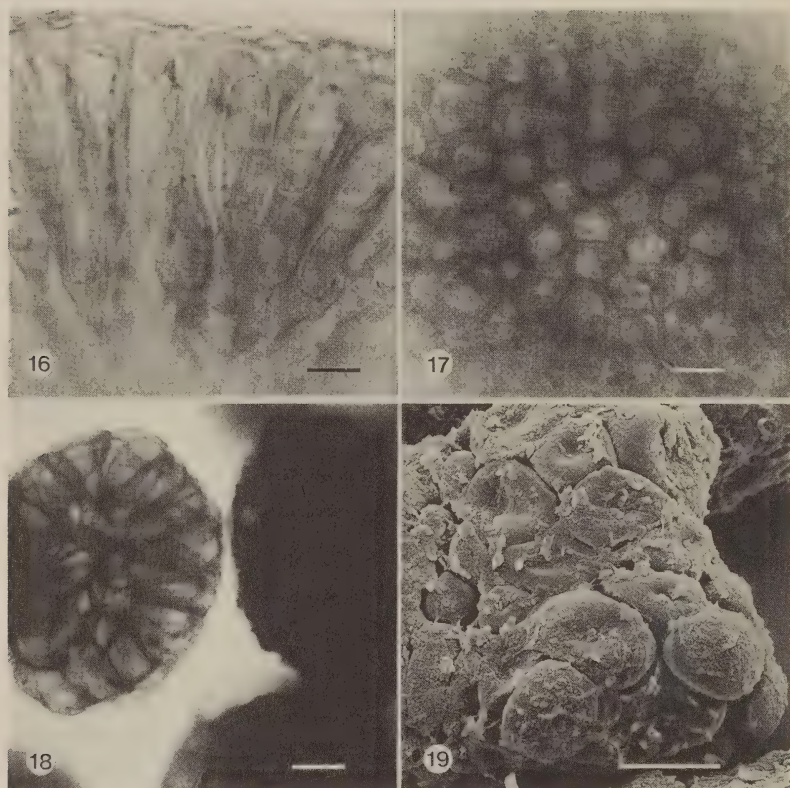
A smut fungus on Caustis blakei, obtained by courtesy of Dr. J. L. Alcorn (Indooroopilly, Australia) tured out to be a new species:

Tolyposporium caustidis K. Vánky, sp. nov.

Typus in matrice Caustis blakei Kük., Australia, Queensland, Murphy's Creek, 27°27'47" S, 152°03'21" E, alt. ca. 400 m, VI.1994, leg. M. Johnston, comm. J. L. Alcorn. Holotypus in Herbario Ustil. Vánky (HUV 16764!), isotypus in BRIP 22292. Paratypes in matrice Caustis blakei Kük., Queensland, Toolara, State Forest, 25°56'00" S, 153°00'55" E, alt. ca. 60 m, 6.X.1994, leg. M. Johnston, comm. J. L. Alcorn (BRIP 22533; HUV 16888!).

Sori (Fig. 20) in floribus, per partes involucales florum perfecte obtecti. Massa glomerulorum sporarum nigra, primo conglutinata, deinde granuloso-pulverea, superficiem organorum floralium internorum abortivorum, hyphis permeatorum obtegens. Glomeruli sporarum (Figg. 18, 19) forma magnitudineque variabiles, late ellipsoidei, usque plerumque irregulares vel elongati, 20–65 x (25–)30–75(–90) μm , atro-brunnei usque opaci, (5–)10–140 sive pluribus? sporis arcte cohaerentibus compositi. Sporae (Figg. 18, 19) visu mediano subcuneiformes, elongatae vel irregulares, 8–17 μm longae, visu superficiali superficies libera earum irregulariter subpolygonalis vel elliptica, (5–)6.5–12 x (6–)7–16(–18) μm , atro-brunnea; paries ad superficiem liberam parum convexus, cca. 1 μm crassus, verrucis irregularibus, 0.5–1 μm altis instructus. Paries laterum conjunctorum tenuis (cca. 0.5 μm), levis.

Sori (Fig. 21) in the flowers, completely hidden by the floral envelopes. The black, first agglutinated, later granular-powdery mass of spore balls covers the surface of the inner, aborted floral organs which are permeated by hyphae. Spore balls (Figs. 18, 19) variable in shape and size, broadly ellipsoidal to usually irregular or elongated, 20–65 x (25–)30–75(–90) μm , blackish-brown to opaque, composed of (5–)10–140 or more?, firmly united spores. Spores (Figs. 18, 19) blackish-brown, in median view subcuneiform, elongate or irregular, 8–17 μm long, in surface view irregularly subpolygonal or elliptic, (5–)6.5–12 x (6–)7–16(–18) μm ; free wall slightly convex, ca. 1 μm thick, provided with irregular, 0.5–1 μm high warts, wall of contact sides thin (ca. 0.5 μm), smooth.



Figs. 16, 17. *Tolyposporium evandrae* Websdane & K. Vánky on *Evandra aristata* R. Br. (type). Bleached spore balls in LM.

Fig. 16. Part of a spore ball showing the elongated spores with thickened walls on the free surface and toward the centre of the ball.

Fig. 17. Surface view of a spore ball.

Figs. 18, 19. *Tolyposporium caustidis* K. Vánky on *Caustis blakei* Kük. (type). Spore balls and spores in LM and in SEM.

(Bars = 10 µm)

***Tolyposporium tricostulariae* Websdane & K. Vánky, sp. nov.**

Typus in matrice *Tricostularia neesii* Lehm., Australia, Western Australia, Ravensthorpe Distr., 25 km E. oppid. Ravensthorpe, 33°35'18" S, 120°20'22" E, 2.XI.1992, leg. K. Websdane. Holotypus in Herbario Ustil. Vánky (HUV 17177!), isotypus in PERTH.

Sori (Fig. 21) in floribus, involucris floralibus perfecte obtecti. Spiculae infectae parum tumefactae. Massa nigra, semiagglutinata glomerulorum sporarum filamenta et partem proximalem antherarum ovariaque obtegens, sed



Fig. 20. *Tolyposporium caustidis* K. Vánky on *Caustis blakei* Kük. (type). Habit and enlarged spikelet with some of the glumes removed showing two flowers (of which the first one is opened) with the black, semiagglutinated mass of spore balls around the inner floral organs.

(Bars = 1 cm and 2 mm respectively)

aristae intactae manentes. Infectio systemica, spiculae omnes eiusdem inflorescentiae affectae. Glomeruli sporarum (Figg. 23, 24) globosi, subglobosi, ellipsoidales, elongati vel parum irregulares, 30–70 x 35–70(–90) μm , atro-rufobrunnei usque opaci, e sporis 15–80 (vel pluribus) firmiter unitis constructi, compressi magis fragiles quam dissolventes. Sporae (Figg. 23, 24) visu mediano subcuneiformes usque elongatae, 9–25 μm longae, atro-rufobrunneae; superficies libera earum polygonaliter irregularis, 4–9 x 5,5–12 μm ; pariete superficiei liberae 1,5–2,5 μm crasso, irregulariter verrucoso, verrucis saepe confluentibus. Sporae omnes poro germinationis rotundo, cca. 2,5 μm diam. instructae, visibili praecipue in sporis juvenilibus adhuc pallide coloratis; pariete laterum contactorum tenui (cca. 0,5 μm), levi.

Sori (Fig. 21) in the flowers, completely hidden by the floral envelopes. Infected spikelets slightly swollen. The black, semiagglutinated mass of spore balls covers the filaments and proximal part of the anthers and the ovaries but the bristles remain intact. Infection systemic, all spikelets of an inflorescence being affected. Spore balls (Figs. 23, 24) globose, subglobose, ellipsoidal, elongated or slightly irregular, 30–70 x 35–70(–90) μm , dark reddish-brown to opaque, composed of 15–80 (or more) firmly united spores which break rather than separate at pressure. Spores (Figs. 23, 24) in median view subcuneiform to elongated, 9–25 μm long, dark reddish-brown; free surface polygonally irregular, 4–9 x 5.5–12 μm ; wall of the free surface 1.5–2.5 μm thick, irregularly verrucose, verrucae often confluent, each spore provided with a round germ pore, ca. 2.5 μm in diameter, visible especially on young, light coloured spores; wall of contact sides thin (ca. 0.5 μm), smooth.

Few single, rounded spores, often with a pedicel-like extension, may occur between the spore balls, or a few spore balls may partly or completely be composed of rounded spores. For possible causes of occurrence of such anomalous spores and spore balls see discussion of the smut of Mesomelaena stygia (Tolyposporium ? melanosporum; opus ipsum).

Tolyposporium cyathochaetae Websdane & K. Vánky, **sp. nov.**

Typus in matrice Cyathochaeta avenacea Benth., Australia, Western Australia, Murray Distr., 80 km S. urbe Perth, 10 km E. oppid. Pinjarra, 32°38'20" S, 116°00' E, 12.III.1992, leg. K. Meney. Holotypus in Herbario Ustil. Vánky (HUV 17174!), isotypus in PERTH. Paratypus in matrice Cyathochaeta clandestina (R. Br.) Benth., Australia, Jerramungup Distr., Western Australia, ca. 170 km NE. urbe Albany, Bremer Bay, 34°24' S, 119°23'23" E, 1.IV.1994, leg. K. Websdane (HUV 17175!), isoparatypus in PERTH.

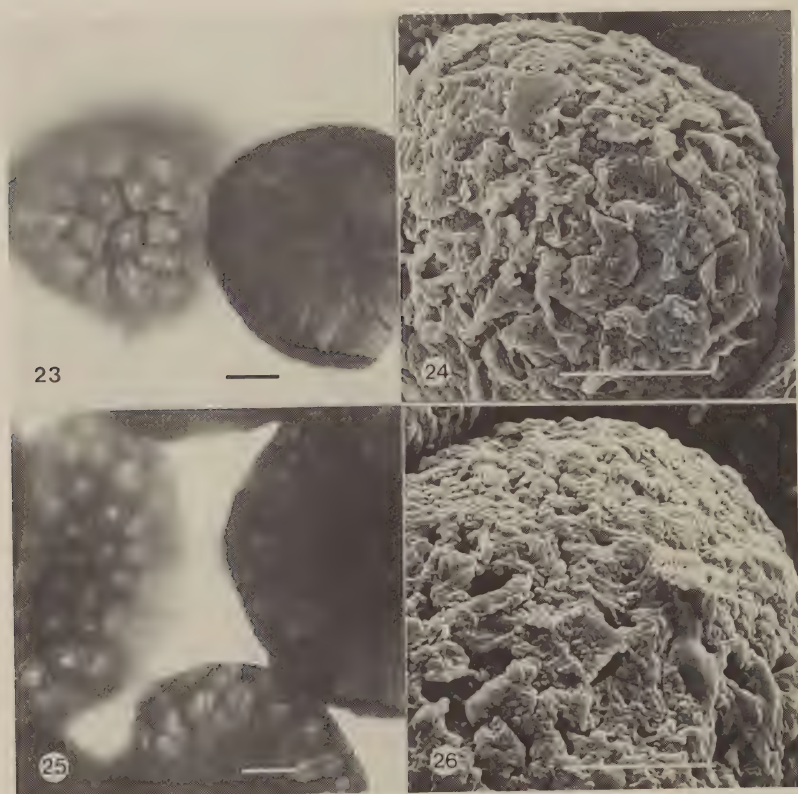
Sori (Fig. 22) in floribus, involucris floralibus partim vel perfecte obtecti. Massa nigra glomerulorum sporarum primo agglutinata, deinde granuloso-pulverea, partem proximalem staminum abortivorum pistillorumque obtogens, insuper ovarium implens. Aristae intactae manentes. Infectio systemica: spiculae omnes eiusdem inflorescentiae affectae. Glomeruli sporarum (Figg. 25, 26) globosi, subglobosi, ovoidei, elongati vel irregulares, 40–90 x 40–120 μm , forte propter conglutinationem maiores, atro-rufobrunnei usque opaci, e sporis 40 ? usque pluries centum firmiter unitis compositi, compressi magis fragiles quam dissolventes. Sporae (Figg. 25, 26) visu mediano subcuneiformes usque elongatae, 8–24 μm longae, atro-rufobrunneae; visu superficiali irregulariter polygonales, 3–9,5 x 5–12 μm ; pariete superficiei liberae parum convexo, 2–3 μm crasso, irregulariter satis crasse verrucoso; pariete laterum contactorum tenui (cca. 0,5 μm), levi. Sporae omnes ad partem liberam parietis poro germinationis centrali, 2–3 μm diam., praecipue in sporis pallidioribus non perfecte maturis conspicuo instructae. Forte sporae paucae abnormales etiam visibiles.



Fig. 21. *Tolyposporium tricostulariae* Websdane & K. Vánky on *Tricostularia neesii* Lehm. (type). A. Habit. B. Infected spikelet. C. A dissected spikelet with the opened first flower showing two of the three stamens with the black, semiagglutinated mass of spore balls around the filaments and the proximal part of the anthers. The bristles remain intact.

Fig. 22. *Tolyposporium cyathochaetae* Websdane & K. Vánky on *Cyathochaeta avenacea* Benth. (type). A. Habit. B. Infected spikelet with some of the glumes removed showing the first flower with the black, semiagglutinated mass of spore balls around the deformed stamens and pistil, and the intact bristles. C. An aborted stamen and the pistil with most of the spore balls removed from the surface. (Bars = 1 cm and 2 mm respectively)

Sori (Fig. 22) in the flowers, partly or completely hidden by the floral envelopes. The black, first agglutinated, later granular-powdery mass of spore balls covers the proximal part of aborted stamens and pistil but also fills the ovary. The bristles remain intact. Infection systemic, all spikelets of an inflorescence being affected. Spore balls (Figs. 25, 26) globose, subglobose, ovoid, elongated or irregular, 40–90 × 40–120 μm , occasionally larger by confluence, dark reddish-brown to opaque, composed of 40? to hundreds of firmly united spores which break rather than separate at pressure. Spores (Figs. 25, 26) in median view subcuneiform to elongated, 8–24 μm long, dark reddish-brown, in surface view the spores are irregularly polygonal, 3–9.5 × 5–12 μm ; wall of the free surface slightly convex, 2–3 μm thick, irregularly, rather coarsely verrucose; wall of contact sides thin (ca. 0.5 μm), smooth. Each spore has on its free wall a rounded, light, central germ pore of 2–3 μm diameter, especially evident in lighter, not fully mature spores. A few anomalous spores may also be present.



Figs. 23, 24. *Tolyposporium tricostulariae* Websdane & K. Vánky on *Tricostularia neesii* Lehm. (type). Spore balls in LM and in SEM.

Figs. 25, 26. *Tolyposporium cyathochaetae* Websdane & K. Vánky on *Cyathochaeta avenacea* Benth. (type). Spore balls in LM and in SEM.

Note the light germ pores on the free wall of the spores in Figs. 23 and 25.

(Bars = 10 μm)

Key to the Tolyposporium species on Cyperaceae, based on host taxonomy.

- On Carex T. aterrimum
 On Caustis T. caustidis
 On Cladium T. littorale
 On Cyathochaeta T. cyathochaetae
 On Evandra T. evandrae
 On Fimbristylis T. mauritianum
 On Ghania T. muellerianum
 On Lepidosperma
 1. Spore balls 50–100 µm long. Spores smooth T. rodwayi
 – Spore balls 50–60 µm long. Spores verrucose T. lepidospermae
 On Mesomelaena
 1. All spore balls composed of the same kind of spores 2
 – Spore balls often composed of different kinds of spores T. (hybrid?)
 2. Spore balls 25–70(–80) µm long, composed of
 (3–)10–40(–80 or more) spores T. mesomelaenae
 – Spore balls 40–110 µm long, composed of
 40–140 (or more) spores T. melanosporum
 On Rhynchospora
 1. Spores apparently smooth. Balls of 1–20(–25?) spores T. fischeri
 – Spores evidently ornamented. Balls of up to 35–50 spores 2
 2. Spore balls irregular, mainly 25–40 µm long, composed of
 (1–)4–25(–35?) subpolyhedral spores T. rhynchosporae-cephalotis
 – Spore balls more regular, mainly 35–44 µm long, composed of
 (6–)10–30 (–50?), mainly subcuneiform spores T. rhynchosporae
 On Schoenus
 1. Spore balls 60–150 µm long, spores 12–35 µm long T. schoeni
 – Spore balls up to 85 µm long, spores up to 25 µm long 2
 2. Spore balls of (2–)10–50 or more spores T. kochianum
 – Spore balls of 40–100 or more spores T. laevigatum
 On Tricostularia T. tricostulariae

ACKNOWLEDGEMENTS

The authors are grateful to Dr. S. Tóth (Gödöllő, Hungary) for providing the Latin descriptions, to Professor N. Lundqvist (Stockholm, Sweden) for serving as pre-submission reviewer, and to Dr. R. Berndt (Tübingen, Germany) for reading the manuscript. The smutted specimens of Caustis blakei, sent to the senior author, are gratefully acknowledged to Dr. J. L. Alcorn (Indooroopilly, Queensland, Australia). We further acknowledge the technical assistance of Mr. H. Schoppmann with SEM, and of Mr. F. Albrecht with photographic work (both Tübingen, Germany).

LITERATURE CITED

- Fischer, G. W. & Holton, C. S. 1957. Biology and control of the smut fungi. - The Ronald Press Co., New York, 622 pp.
 Kile, G. A. & Grgurinovic, C. A. 1995. Developing mycological awareness in Australia. - Mycologist 9:29-30.
 Schröter, J. 1887. Ustilaginei. In F. Cohn, Kryptogamen-Flora von Schlesien 3(1):261-291. - Breslau.
 Vánky, K. 1987. Illustrated genera of smut fungi. - Cryptogamic Studies 1:1-159. Gustav Fischer Verlag, Stuttgart / New York.
 Wilson, K. L. 1981. Revision of the genus Mesomelaena (Cyperaceae). - Telopea 2:181-195.

LICHENS AND LICHENICOLOUS FUNGI OF THE NORTHERN KRASNOYARSK TERRITORY, CENTRAL SIBERIA

Mikhail ZHURBENKO

*Laboratory of Systematics and Geography of Fungi, Komarov Botanical
Institute, Prof. Popov str. 2, St.-Petersburg 197376 Russia.
E-mail: binran@glas.apc.org*

Abstract: A list of lichens and lichenicolous fungi (660 and 61 taxa, respectively) of the northern Krasnoyarsk Territory, Central Siberia, is presented. Literature records and additional new records from 53 localities in the area are summarized. Information on altitudinal and zonal ranges of the taxa is included. Most of the lichenicolous fungi and the following lichens are new to Russia: *Acarospora* cf. *rhizobola*, *Agonomia tristicula*, *Lecanora cavicola*, and *Pertusaria christae*. *Acarospora* cf. *scabrida*, *Anaptychia bryorum*, *A. ciliaris*, *Anzina carneonivea*, *Arctoparmelia subcentrifuga*, *Biatora carneoalbida*, *Biatorella hemisphaerica*, *Buellia pulverulenta*, *Caloplaca castellana*, *Cyphelium pinicola*, *Gyalecta* cf. *kukriensis*, *Gypsoplaca* sp., *Immersaria athroocarpa*, *Lecanora mughicola*, *L. sulphurea*, *Peltigera elisabethae*, *P. frippii*, *P. kristinssonii*, *Porpidia tuberculosa*, *Rinodina parasitica*, *Teloschistes contortuplicatus*, *Thelocarpon epibolum*, *Thelomma ocellatum*, *Xanthoria borealis*, and *Xylographa vitiligo* are new to the northern part of Central Siberia, and some of these taxa are possibly new to Siberia as a whole.

INTRODUCTION

During my work on the local lichen floras of the Putorana Plateau and Taymyr Peninsula (Zhurbenko 1989, 1992a,b, 1993a,b), it became evident that summarizing present knowledge of the lichen flora of the northern Krasnoyarsk Territory would be helpful since it would provide baseline information and stimulate further studies in the area. This list is also a contribution to the compilation of the Panarctic mycobiota, a project now being promoted in many arctic countries. The distributions of some taxa were discussed in previous studies by Chernov & Matveeva (1979) and

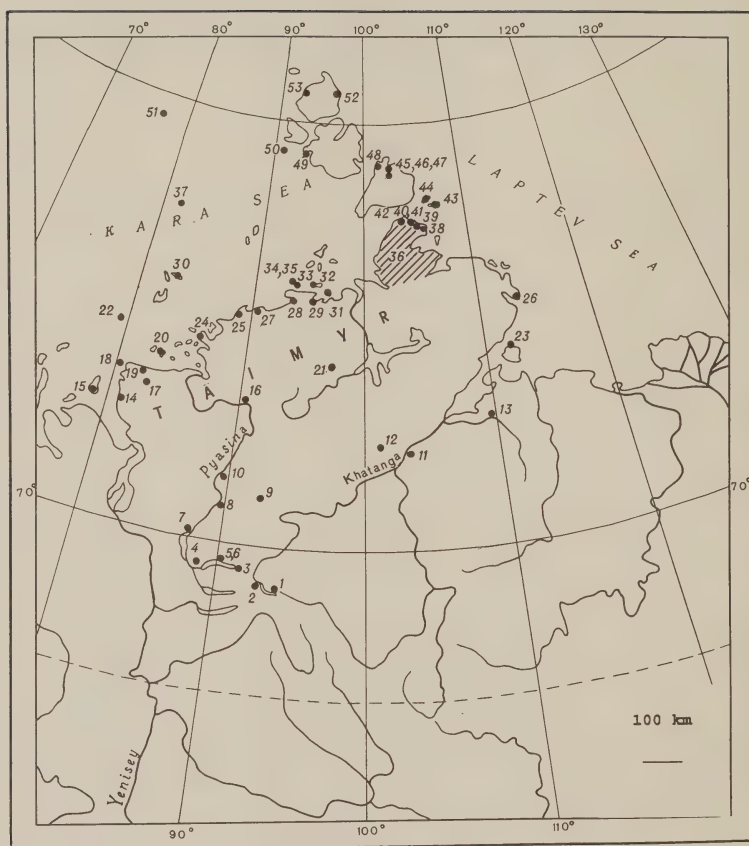


Fig. 1. Map of the collection sites of lichens and lichenicolous fungi in the northern Krasnoyarsk Territory.

Kuvajev (1980). Additional phytogeographical information is presented here.

Lichenicolous fungi from the Putorana Plateau, were identified mostly by Josef Hafellner (Hafellner & Zhurbenko 1994). Further contributions to the knowledge of this in Russia neglected group of fungi are included in Zhurbenko & Santesson (1995).

Krasnoyarsk Territory is a vast area covering most of Central Siberia. The North Krasnoyarsk Territory lies within the boundaries of the Taymyrskiy avtonomnyy Okrug (Fig. 1). At its southern edge it includes the northern part of the Central Siberian Plateau, and extends to the Severnaya Zemlya Archipelago and the other islands of the Kara and Laptev Seas to the north. The western boundary of the area studied lies east of the Yenisey River, and the eastern between the Popigay and Anabar Rivers. Preobrazheniya Island, referred to as the Sakha-Yakutiya Republic, is also included. Lichen reports from the Arctic Yakutiya situated east of the area discussed here, is found in a comprehensive compilation by Fes'ko (1991).

The first scientific lichen collections from the area were made by A. T. Middendorff, who in a expedition in 1843 crossed the Taymyr Peninsula from Dudinka to the mouth of the Nizhnyaya Taymyra River. The material was identified by Nylander (1867). Numerous lichen specimens from the region of the lower Yenisey, e.g. from Dudinka, Tolsty Nos, Nikandrovskie Islands, were collected in 1876 by Mårten M. Brenner. This interesting material has only rarely been reported on in some publications, e.g. by Magnusson (1944, 1947, 1950), and was deposited in different herbaria (H, GB, S, UPS).

The first significant contributions to the knowledge of Taymyr lichens were made by sea-based expeditions along the polar coast of Siberia, first of all by the Nordenskiöld expedition with "Vega" in 1878-79 and E. V. Toll's expedition with "Zarya" in 1900-01 (Almquist 1882; Elenkin 1906, 1909; Lynge 1929; Magnusson 1944, 1947; Malme 1932; Savicz 1916). In 1930 extensive collections from the Severnaya Zemlya and the Voz Islands were made by V. P. Savicz. Unfortunately this material was never identified, and the first report of lichens of Severnaya Zemlya Archipelago was not published until in 1958 by Korotkevich.

Although the lichen flora of coastal areas of the Taymyr Peninsula and the adjacent islands thus is comparatively well-documented, the mainland territories have for long remained practically unexplored. Some information about common lichens of the interior regions of the Taymyr Peninsula was between 1910 and 1940 obtained by expeditions of Pereselencheskoe Upravlenie (the Migration Ministry) and other institutions during investigations of natural resources of the northern areas (Alexandrova 1937; Avramtchik 1937; Kuznetsov 1916, 1932; Sambuk 1937; Tyulina 1937; Vinogradova 1937). Further contributions to the knowledge of the

distribution of lichens prominent in the vegetation of the area were made in applied geobotanical investigations, e.g. of reindeer pastures. These studies were primarily carried out by investigators of the Institute of Agriculture at the Extreme North (Anonymous 1975, Kuvajev *et al.* 1974, Shchelkunova 1979). Valuable information on the older reports can be found in Oxner (1940-1942) and Savicz & Elenkin (1950).

The next period of lichenological studies in the area began in the late 1960s as a part of comprehensive biological investigations at a number of semi-permanent research stations such as Tareya, Agapa, Ary-Mas, Putorana, and Mys Baranova. These studies, carried out under the leadership of the Polar Expedition, Komarov Botanical Institute, benefited greatly from international collaboration (Ahti & Zhurbenko 1994; Andreev *et al.* 1993; Kotlov 1993a,b,c; Moberg & Zhurbenko 1994; Piin 1977a,b, 1979a,b, 1982, 1984; Piin & Martin 1978; Piin & Trass 1971; Pospelova 1974; Söchting *et al.* 1992; Titov 1984; Zhurbenko & Hansen 1992, 1993; Zhurbenko & Söchting 1993).

The present list of lichens and lichenicolous fungi of the northern Krasnoyarsk Territory shows that the area still is insufficiently explored lichenologically. Most of the collections have so far been made by non-lichenologists. The localities studied are predominantly situated along the coast of the Taymyr Peninsula, the Pyasina River, and in the northwestern Putorana Plateau area. The vast interior areas of the Taymyr Peninsula, particularly the Byrranga Mountains and the territories east of the Ayan, Kheta and Khatanga Rivers are virtually unstudied.

MATERIALS AND METHODS

The list presented here was compiled from literature records and results from studies of material from 53 localities. The majority of the lichen specimens collected from this area are housed in St.-Petersburg (LE), Tartu (?) (TU), Tallinn (TALL) [abbreviations follow Holmgren *et al.* (1990)]. Material from the Vega (1878-1879) and Maud (1918-1925) expeditions are deposited mainly in Stockholm (S) and Oslo (O). Some material is located in Bergen (BG), Ottawa (CANL), Copenhagen (C), Essen (ESS), Graz (GZU), Göteborg (GB), Helsinki (H), Munchen (M), Moscow (MW), and Uppsala (UPS). Specimens of lichenicolous fungi are preserved in St. Petersburg (LE), Graz (GZU), and Uppsala (UPS).

Geographical names, except in cases where there is an established custom, were obtained from *The Times Atlas of the World* (1990) or from the 1:1,000,000 and 1:300 000 maps published in the USSR (1954 or later) and transliterated. Cyrillic transliterations follow accepted standards of *The Times Atlas*. The nomenclature of lichens and lichenicolous fungi mostly follows Santesson (1993), that of vascular plants Tolmachev & Yurtsev

(1960-1987). Names in *Cladoniaceae* were verified in Ahti (1993). Author citations follow Brummitt & Powell (1992). Titles of the periodicals are abbreviated according to Bridson & Smith (1991).

AREA STUDIED

The northern Krasnoyarsk Territory includes both the vast boggy plain areas of the Northern Siberian Lowland and major mountain systems. Mountainous areas include the northern part of the Central Siberian Plateau with the Putorana Plateau (elevations of up to 1701 m) and the Anabar Mountains (elevations of up to 905 m), the Byrranga Mountains in the northern part of the Taymyr Peninsula (highest peak at 1146 m) and the mountains of the Severnaya Zemlya Archipelago covered mostly by glaciers (elevations up to 965 m).

Most of the area is influenced by the continental Siberian climate; only the western part of the Taymyr Peninsula, adjacent to the Yenisey River and its gulf, has a climate with maritime influence (Treshnikov 1985). The area north of the Krasnoyarsk Territory is situated within the zone of continuous permafrost. The vegetation in the northern part of the territory is strongly influenced by frost. Some climatic data of different vegetation zones from the Taymyr Peninsula and adjacent areas are presented in Table 1.

Table 1. Mean monthly temperatures and precipitation of different vegetation zones of the Taymyr Peninsula and neighbouring areas (adopted from Treshnikov 1985)

ZONE	Mean monthly temp.(°C)		Precipitation (mm)	
	July	January	July	Annual
PD	0-+4	-28-30	25-50	200-400
AT	+4- 8	-28-30	25-75	300-400
TT	+4-12	-28-30	50-75	(300)400-600
ST	+8-12	-28-30	50-75	(300)400-600
FT	ca.+12	-28-30	50-100	400-800
Putorana	+10-12	-28-30	75-100	800-1000

PD - polar desert, AT - arctic tundra, TT - typical tundra, ST - southern tundra, FT - forest-tundra, Putorana - subarctic plateau with mountain belts from northern taiga to alpine tundra.

The northern Krasnoyarsk Territory lies mostly within the arctic floristic division of the East-Siberian Province, Taymyr Subprovince (Yurtsev *et al.* 1978). The vegetation of the subarctic highlands, as exemplified by the Putorana Plateau, is divided into three distinct altitudinal belts (Norin 1986). The lower belt of northern taiga (NT) is composed mainly of *Larix sibirica* and *L. gmelinii* forests. The subalpine belt (SA) is dominated by *Duschekia fruticosa* and *Betula nana* shrubs. The alpine tundra belt (AIT) at the upper levels of the plateau (altitudes 800-1300 m), is represented by communities mostly dominated by *Dryas punctata* and *Cassiope tetragona* combined with a patchy plant cover and stone fields mostly inhabited by crustaceous lichens.

Northwards of the Central Siberian Plateau lies a transitional zone of forest-tundra (FT), dominated by such species as *Larix gmelinii*, *Empetrum subholarcticum*, *Dryas punctata*, *Ledum palustre*, *Vaccinium vitis-idaea* s.l., *Cladina* spp., *Pleurozium schreberi*, *Hylocomium splendens* v. *alaskanum*, *Ptilidium ciliare*.

The tundra zone of the Taymyr Peninsula is subdivided here according to Chernov & Matveeva (1979). Its southern (or shrub) tundra subzone (ST) is characterized by closed shrub vegetation in upland type tundras. Species frequently dominating are *Duschekia fruticosa*, *Betula nana*, *Salix lanata*, *Vaccinium uliginosum* s.l., *V. vitis-idaea* s.l., *Rubus chamaemorus*, *Arctous alpinus*, *Empetrum subholarcticum*.

The subzone of typical tundra (TT), or moss tundra, is characterized by dominance of dwarf-shrubs (*Dryas punctata*, *Cassiope tetragona*), sedges, bryophytes (*Hylocomium splendens* v. *alaskanum*, *Aulacomnium turgidum*, *Tomenthypnum nitens*) and partially in upland tundras by lichens. A bryophyte understory is a dominant feature of the plant communities and provides continuous vegetation coverage. Shrubs (*Salix reptans*, *S. arctica*) also occur in upland tundras, but never form close stands and usually have a prostrate form.

The Arctic tundra subzone (AT) is characterized by a disrupted, net-like plant coverage resulting in polygonal and spotty tundras dominated by, e.g. *Salix polaris*, *Luzula confusa*, *Alopecurus alpinus*, *Papaver polare*, *Hylocomium splendens* v. *alaskanum*, *Aulacomnium turgidum*, *Tomenthypnum nitens* and various lichens.

The polar desert zone (PD) (sensu Alexandrova 1983) covers the northern extremity of the Taymyr Peninsula with Cape Chelyuskin, the Severnaya Zemlya Archipelago and some other northern islands in the Kara and Laptev Seas. It is characterized by a significant reduction of the plant cover (ranges usually from 5 to 30%), and a strong patchiness. Dominating plants are lichens and bryophytes, but never phanerogams. The cushion-plant life form is very common here.

ABBREVIATIONS

AIT - alpine tundra belt.
 AT - arctic tundra subzon of tundra zone.
 FT - forest-tundra.
 NT - northern taiga belt.
 PD - polar desert zone.
 SA - subalpine belt.
 ST - southern tundra subzone of tundra zone.
 TT - typical tundra subzone of tundra zone.

NT/SA etc. - transition between the units.
 NT - AIT etc. - ranges from NT to AIT.

B. - bay.
 C., Cs. - cape(s).
 I., Is. -island(s).
 L. - lake.
 Mt., Mts. - mountain(s).
 Pen. - peninsula.
 R., Rs. - river(s).

ap. - apotheci-um(a).
 th. - thallus.

LIST OF LOCALITIES

Localities are arranged from south to north and from west to east. Coordinates were obtained from Isakov (1952) or from 1:1 000 000 and 1:300 000 maps (published since 1952 by GUGK, USSR); altitudes follow these maps. References to the altitudinal and/or zonal vegetation units, information about collectors, year of collecting, and main herbaria in which the specimens are deposited (if possible), as well as references to literature or unpublished data are also provided. The numbering of the localities is used in the "List of taxa" below.

Putorana Plateau

1. Near the southern end of Lake Ayan, 69:00 N, 94:15 E, 470-1300 m, NT - AIT, coll. M. Zhurbenko, 1984, LE (Ahti & Zhurbenko 1994, Hafellner & Zhurbenko 1994, Moberg & Zhurbenko 1994, Zhurbenko 1989, Zhurbenko & Poelt 1994).

2. Near the northern end of Lake Ayan, 69:18 N, 93:35E, 470-1200 m, NT - AIT, coll. M. Zhurbenko, 1984, LE (Hafellner & Zhurbenko 1994, Poelt & Zhurbenko 1994, Zhurbenko 1989, Zhurbenko & Poelt 1994).
3. Near the eastern end of Lake Lama, 69:23 N, 91:39 E, NT - SA, 53-700 m, coll. M. Zhurbenko, 1984, LE (Hafellner & Zhurbenko 1994, Zhurbenko 1989, Zhurbenko & Poelt 1994).
4. Near the town Talnakh, 69:29 N, 88:32 E, 80-500 m, NT - AIT, coll. M. Zhurbenko, 1985 & A. Bucek and R. Kostka, 1990, LE, GZU (Hafellner & Zhurbenko 1994, Zhurbenko 1989, Zhurbenko & Poelt 1994).
5. Near Lake Kapchuk, 69:29 N, 91:00 E, 55-1000 m, NT - AIT, coll. M. Zhurbenko, 1983, 1985 & A. N. Titov, 1982, LE (Hafellner & Zhurbenko 1994, Poelt & Zhurbenko 1994, Titov 1984, Zhurbenko 1989, Zhurbenko & Poelt 1994).
6. Near the centre of Lake Lama, 69:30 N, 90:42 E, 53-1200 m, NT - AIT, coll. M. Zhurbenko, 1985, LE (Hafellner & Zhurbenko 1994, Zhurbenko 1989, Zhurbenko & Poelt 1994).

Taymyr Peninsula and neighbouring islands

7. Near the northern end of Lake Pyasino, 70:05 N, 87:43 E, 30-150 m, ST, coll. M. Zhurbenko, 1983, LE (Ahti & Zhurbenko 1994, Zhurbenko 1993a).
8. Near the settlement of Kresty, 70:52 N, 89:57 E, 15-50 m, ST, coll. N. V. Matveeva, L. L. Zanolkha & N. V. Sdobnikova, 1975-77, TALL, TU (?) (Piin 1984).
9. The middle course of Dudypa R., c. 71:10 N, 92:40 E, 20-50 m, FT/ST, coll. M. N. Avramtchik, 1934 (Avramtchik 1937).
10. Near the settlement of Agapa, 71:26 N, 89:14E, 10-120 m, ST/TT, coll. E. B. Pospelova & Yu. G. Zharkova, 1970 (Pospelova 1974).
11. Between Zhdanikha and Khatanga Rs., 72:10 N, 102:53 E, 1-50 (100) m, FT/ST, coll. L. N. Tyulina, 1934 (Tyulina 1937).
12. Urochishche Ary-Mas, 72:28 N, 101:53 E, 5-50 m, FT+TT (forest island in TT), coll. Yu. L. Martin, 1970-71, TU (?), TALL (Piin & Martin 1978).
13. Region of Popigay R., c.72:30 N, 109:00 E, 5-50 (100) m, ST/TT, coll. V. D. Alexandrova, 1934 (Alexandrova 1937).
14. Near the mouth of River Ragozinka, 72:48 N, 80:53 E, 0-50 m, TT, coll. M. Zhurbenko, 1990, LE (Søchting *et al.* 1992, Zhurbenko 1992a, Zhurbenko & Hansen 1992, Zhurbenko & Santesson 1995, unpublished data of M. Zhurbenko).

15. Sibiryakova I., 72:55 N, 79:00 E, 0-30 m, TT, coll. W. B. Kuvajev & A. Kozhevnikova, 1989-1990, LE, MW (Kuvajev *et al.* 1994, Zhurbenko & Santesson 1995).
16. Between Pyasina and Tareya Rs., 73:16 N, 90:36 E, 5-50 (100) m, TT; coll. H. Trass, 1966, T. Piin, 1967 & N. V. Matveeva, 1966-68; TALL, TU (?) (Piin & Trass 1971).
17. Region of the Right Uboynaya R., 73:25 N, 82:51 E, 60-217 m, AT, coll. M. Zhurbenko, 1990, LE (Zhurbenko. Lichens from the Lower Right Uboynaya...).
18. Dikson I., 73:30 N, 80:20 E, 0-50 m, AT (?); coll. E. Almquist, 1878, A. A. Bjalynicki-Birula, 1900 & M. Zhurbenko, 1990; LE (Almquist 1882, Elenkin 1909, unpublished data of M. Zhurbenko).
19. Mouth of Uboynaya R., 73:39 N, 82:22 E, 5-20 m, AT, coll. M. Zhurbenko, 1990, LE (Søchting *et al.* 1992; Zhurbenko & Hansen 1992, 1993; unpublished data of M. Zhurbenko).
20. Kamennye Is., c. 74:05 N, 83:00 E, 0-100 (159) m, AT, coll. A. A. Bjalynicki-Birula, 1900, LE (Elenkin 1909).
21. Byrranga Mts., region of Bol'shaya Bootankaga R. and Lewinson-Lessinga L., c. 74:30 N, 98:30 E, 50-450 m, AT, PD (altitudinal counterpart of PD), coll. W. B. Kuvajev, 1991 & M. Zhurbenko, 1994, C, GZU, LE, MW, O, UPS (Zhurbenko & Santesson 1995, unpublished data of M. Zhurbenko and W. B. Kuvajev).
22. Sverdrupa I., 74:35 N, 79:25 E, 0-33 m, AT, coll. Yu. P. Kozhevnikov, 1992, LE (Kozhevnikov *et al.* 1994).
23. Preobrazheniya I., 74:42 N, 113:00 E, 0-50 m, TT, coll. E. Almquist, 1878 (Almquist 1882; Magnusson 1944, 1947; Malme 1932).
24. Minina Skerries, 74:45 N, 85:30 E, 0-60 m, AT, coll. E. Almquist, 1878 (Almquist 1882; Magnusson 1944, 1947; Malme 1932).
25. C. Sterlegova, 75:23 N, 88:45 E, 0-25 (50) m, AT, coll. E. A. Khodachek, LE (Khodachek & Makarova, in prep.).
26. Marii Pronchishchevoy Pen., 75:32 N, 113:26 E, 0-50 m, AT, coll. T. Piin & N. V. Matveeva (?), TALL, TU (?) (Piin 1979b, Thomson & Bird 1978).
27. Kharitona Lapteva Coast between Cs. Vilda and Stellinga, c. 75:40 N, 91:26 E, 0-50 m, AT, coll. I. I. Trschemesky, 1915, LE (Savicz 1916).
28. Region of Middendorffa B., 75:54 N, 92:59 E, 0-50 (100) m, AT, coll. A. A. Bjalynicki-Birula, 1900, LE (Elenkin 1909).
29. Southern coast of Taymyr B., 75:55 N, 97:00 E, 0-50 m, AT, coll. A. A. Bjalynicki-Birula, 1901, LE (Elenkin 1909).
30. Troynoy I., 76:00 N, 82:50 E, 0-42 m, AT, coll. Yu. P. Kozhevnikov, 1992, LE (Kozhevnikov *et al.* 1994, Zhurbenko & Santesson 1995).
31. Siversiya I. at Taymyr B., 76:05 N, 96:29 E, 0-50 m, AT, coll. A. A. Bjalynicki-Birula, 1901, LE (Elenkin 1909).

32. Taymyr I., 76:13 N, 96:10 E, 0-200 (235) m, AT/PD(?), coll. E. Almquist, 1878 & A. A. Bjalynicki-Birula, 1901, LE (Almquist 1882; Elenkin 1909; Magnusson 1944, 1947; Malme 1932).
33. Region of Nansena I., c. 76:15 N, 94:56 E, 0-100 m, AT/PD (?), coll. A. A. Bjalynicki-Birula, 1901, LE (Elenkin 1909).
34. Small island west of Taymyr I., 76:16 N, 93:42 E, AT/PD (?), coll. E. Almquist, 1878 (Almquist 1882, Malme 1932).
35. Small island west of Taymyr I., 76:18 N, 94:03 E, AT/PD (?), coll. E. Almquist, 1878 (Almquist 1882, Malme 1932).
36. Region of C. Chelyuskina, 76:33 - 77:41 N, 102:20 - 107:19 E, 25-250 m, PD, coll. "Maud" expedition, 1918-19, O (Lyngé 1929).
37. Uedineniya I., 77:30 N, 82:20 E, 0-25 m, PD, coll. I. I. Trschemesky, 1915, LE (Savicz 1916).
38. Region of C. Pronchishcheva ("C. Hansen") in Maud B., 77:32 N, 105:40 E, 0-50 m, PD, coll. "Maud" expedition, 1918-19, O (Lyngé 1929).
39. Taymyr coast to south-east of C. Papanina ("Bear C."), 77:36 N, 104:58 E, 0-25 m, PD, coll. "Maud" expedition, 1918-19, O (Lyngé 1929).
40. C. Papanina in Mod ("Maud") B., 77:38 N, 104:51 E, 0-50 m, PD, coll. Yu. V. Kotlov, 1992, LE (Kotlov 1993a).
41. Taymyr coast between Cs. Shcherbina and Papanina ("27 km W-NW of Maud B."), 77:41 N, 104:50 E, 0-50 m, PD, coll. "Maud" expedition, 1918-19, O (Lyngé 1929).
42. Cape Chelyuskin ("Tscheljuskin"), 77:43 N, 104:15 E, 0-50 m, PD; coll. E. Almquist, 1878, A. A. Bjalynicki-Birula, 1901, "Maud" expedition, 1918-19, I. N. Safronova, 1973, V. Mazing, 1974 & N. V. Matveeva, 1974; LE, TALL, TU (?), O (Almquist 1882; Elenkin 1909; Lyngé 1929; Magnusson 1944, 1947; Malme 1932; Piin 1979a).
43. Malyy Taymyr I., 78:05 N, 107:20 E, 0-31 m, PD, coll. "Maud" expedition, 1918-19, O (Lyngé 1929).
44. Starokadomskogo I., 78:15 N, 106:30 E, 0-39 m, PD, coll. "Maud" expedition, 1918-19, O (Lyngé 1929).

Severnaya Zemlya Archipelago and Vize I.

45. Bol'shevik I., upper part of Bazovaya R., 78:55 N, 102:00 E, 70-80 m, PD, coll. I. N. Safronova, 1991, LE (Andreev *et al.* 1993)
46. Bol'shevik I., middle part of Bazovaya R., 79:04 N, 102:25 E, 60-70 m, PD, coll. I. N. Safronova, 1991, LE (Andreev *et al.* 1993).
47. Bol'shevik I., lower part of Bazovaya R., 79:07 , 102:45 E, 0-60 m, PD, coll. I. N. Safronova 1991, LE (Andreev *et al.* 1993).

48. Bol'shevik I., region of C. Baranova - "Mys Baranova" station, c.79:15 N, 101:45 E, 0-40 m, PD, coll. I. N. Safronova, 1991 & Yu. V. Kotlov, 1992, LE (Andreev *et al.* 1993; Kotlov 1993b,c).
49. Oktyabr'skoy Revolutsii I., Zhiloy Pen., 79:26 N, 94:00 E, 0-25 (50) m, PD; coll. E. A. Khodachek, 1979, 1980, 1982; LE (Andreev 1983, Khodachek 1986).
50. Sredniy I., 79:28 N, 91:13 E, 0-50 m, PD; coll. E. A. Khodachek, 1979, 1980, 1982; LE (Andreev 1983, Khodachek 1986).
51. Vize I., 79:30 N, 76:50 E, 0-25 m, PD, coll. V. P. Savicz, 1930, LE (Zhurbenko & Santesson 1995, unpublished data of M. Zhurbenko).
52. Komsomolets I., Zhuravleva B., 80:48 N, 93:27 E, 0-30 m, PD, coll. I. N. Safronova, 1991, LE (Andreev *et al.* 1993).
53. Komsomolets I., C. Lokot', 80:48 N, 97:50 E, 0-10 m, PD, coll. I. N. Safronova, 1991, LE (Andreev *et al.* 1993).

LIST OF TAXA

Taxa are provided with references to the collection localities (numbers correspond to those in the list of localities) and to the range of altitudinal and/or zonal distribution (see "Abbreviations"). In some cases information about revisions and location of specimens is also provided. Lichenicolous fungi are supplied with host indication. Doubtful records are marked with "?". Synonyms, misused names and misidentifications are marked "=".

I. LICHENS

- ACAROSPORA fuscata* (Schrad.) Th. Fr. - 18, 32 (AT, AT/PD).
A. hospitans H. Magn. - 36 (PD).
A. molybdina (Wahlenb.) A. Massal. - 18, 24 (AT).
A. peliscypha Th. Fr. - 14, 17 (TT, AT).
A. putoranica N. S. Golubk. & Zhurb. - 1 - 3, 5, 6, 21 (NT - AIT, AT); (GZU, LE, O, UPS).
A. cf. rhizobola (Nyl.) Alstrup - 17 (AT), (LE).
A. cf. scabrida Hedl. ex H. Magn. - 21 (AT), (LE, UPS).
A. scyphulifera Vain. - 32 (AT/PD).
A. smaragdula (Wahlenb. in Ach.) A. Massal. - 32 (AT/PD).
A. veronensis A. Massal. - 3 (SA).

- AGONIMIA tristicula* (Nyl.) Zahlbr. - 1 (NT, NT/SA); det. J. Hafellner, 1994 (LE).

ALECTORIA bicolor (Ehrh.) Nyl. = *Bryoria bicolor*.

A. nigricans (Ach.) Nyl. - 2, 6, 7, 8, 12, 14, 15 - 19, 21 - 26, 30, 32, 34, 35, 42, 46, 48 - 51 (AIT, FT - PD).

A. ochroleuca (Hoffm.) A. Massal. - 1 - 19, 21 - 23, 25 - 28, 30, 32, 34, 35, 42, 46, 48 - 51 (NT - AIT, FT - PD).

ALLANTOPARMELIA alpicola (Th. Fr.) Essl. - 17 - 19, 24, 30, 32, 34 - 36, 42, 46, 52 (AT, PD).

? *A. sibirica* (Zahlbr.) Essl. Syn. *Parmelia nigra* Vain. - 30 (cf.), 36 (AT, PD).

AMANDINEA coniops (Wahlenb. in Ach.) Scheid. Syn. *Buellia coniops* (Wahlenb. in Ach.) Th. Fr. - 24, 48 (AT, PD).

A. punctata (Hoffm.) Coppins & Scheid. Syn. *Buellia punctata* (Hoffm.) A. Massal. - 1 - 3, 23, 24, 32 (NT, SA, TT - AT/PD).

AMYGDALARIA elegantior (H. Magn.) Hertel & Brodo - 3 (NT).

A. panaeola (Ach.) Hertel & Brodo - 2, 3 (SA).

A. pelobotryon (Wahlenb.) Norman - 5 (NT).

ANAPTYCHIA bryorum Poelt - 14 (TT); rev. R. Moberg, 1993 (UPS).

A. ciliaris (L.) Körb. - 21 (AT); rev. R. Moberg, 1995 (GZU, LE, UPS).

ANZINA carneonivea (Anzi) Scheid. in Vězda - 4 (SA); det. J. Poelt (GZU).

ARCTOCETRARIA andrejevii (Oksner) Kärnefelt & Thell. Syn. *Cetraria andrejevii* Oksner - 5, 8, 14, 15, 19, 25, 42, 48 (NT, ST - PD).

A. nigricascens (Nyl.) Kärnefelt & Thell. Syn. *Cetraria nigricascens* (Nyl.) Elenkin - 7, 8, 14, 15, 22, 30, 42, 48 (ST - PD).

ARCTOMIA delicatula Th. Fr. - 1 - 3, 5, 8, 12, 16, 21, 23, 26, 42 (NT - AIT, FT - PD).

A. interfixa (Nyl.) Vain. - 2, 8, 12, 26, 42 (NT, SA, FT - PD).

ARCTOPARMELIA centrifuga (L.) Hale - 1, 3, 4, 6, 14, 17, 18, 21, 32, 34, 35, 48 (NT - AIT, TT - PD).

A. incurva (Pers.) Hale - 1, 2, 5, 17, 18, 24, 28, 32, 34, 35 (NT - AIT, AT, AT/PD).

A. separata (Th. Fr.) Hale. Syn. *Parmelia birulae* Elenkin - 1 - 6, 14, 16 - 19, 21, 32 - 34, 35 (NT - AIT, TT - AT/PD).

A. subcentrifuga (Oksner) Hale - 2, 3, 6 (NT, AIT); rev. J. Poelt, 1994 (GZU, LE).

ARCTOPELTIS thuleana Poelt. Syn. *Lecanora contractula* Nyl. v. *feracissima* (Th. Fr.) Vain. - 24 (AT).

ARTHONIA exilis (Flörke) Anzi - 42 (PD).

A. glebosa Tuck. Syn. *Toninia groenlandica* Lynge - 1, 2 (NT, SA); rev. E. Timdal, 1991 (LE).

ARTHORRHAPHIS alpina (Schaer.) R. Sant. - 8, 12, 16, 49 (FT - PD).

A. citrinella (Ach.) Poelt - 1 - 6, 8, 12, 26, 42 (NT - AIT, FT - PD).

A. vacillans Th. Fr. & Alm. ex Th. Fr. - 1, 2, 8, 19, 24, 26, 42, 51 (AIT, ST - PD).

ASAHINEA chrysanthia (Tuck.) W. L. Culb. & C. F. Culb. - 1 - 8, 10, 12, 14, 16, 17, 21 (NT - AIT, ST - AT/PD).

A. scholanderi (Llano) W. L. Culb. & C. F. Culb. - 14, 16, 17, 21 (TT - AT).

ASPICILIA alboradiata (H. Magn.) Oksner - 1 (cf.), 48 (SA, PD); was also reported from the low Yenisey, region of Dudinka (Oksner 1971:210).

A. anseris (Lynge) Andreev. Syn. *Lecanora anseris* Lynge - 47 (PD).

A. alphoplaca (Wahlenb.) Poelt & Leuckert = *Lobothallia alphoplaca*.

A. aquatica Körb. - 5, 48 (AIT, PD).

A. caesiocinerea (Nyl. ex Malbr.) Arnold - 3, 32 (?) (NT, AT/PD).

A. calcarea (L.) Mudd coll. - 23 (TT).

A. cinerea (L.) Körb. - 3, 42 (NT, PD).

? *A. contorta* (Hoffm.) Kremp. Syn. *A. hoffmannii* (Ach.) Flagey - 3 (NT, SA)

? *A. cupreoatra* (Nyl.) Arnold - 3 (SA).

A. disserpens (Zahlbr.) Räsänen - 48 (PD).

A. gibbosa (Ach.) Körb. - 23, 32, 42 (TT - PD).

A. hoffmannii (Ach.) Flagey = *A. contorta*.

A. hyperboreorum (Zahlbr.) Oksner - 48 (PD).

A. laevata (Ach.) Arnold - 42 (PD).

A. lapponica (Zahlbr.) Oksner - 47, 48 (PD).

A. mastrucata (Wahlenb.) Th. Fr. - 32 (AT/PD).

A. melanaspis (Ach.) Poelt & Leuckert = *Lobothallia melanaspis*.

A. perradiata (Nyl.) Hue. Syn. *Lecanora perradiata* Nyl. - 23, 36, 39, 42, 44 (TT, PD).

A. phaeops (Nyl.) Stein = *Lecidea phaeops*.

A. plicigera (Zahlbr.) Räsänen - 48 (PD).

A. sublapponica (Zahlbr.) Oksner - 48 (PD).

A. subplicigera (H. Magn.) Oksner - 48 (PD).

A. transbaicalica Oksner - 1, 2 (NT, SA).

BACIDIA bagliettoana (A. Massal. & De Not.) Jatta - 1 - 3, 8, 12, 16, 26, 42 (NT - AIT, ST - PD).

B. herbarum (Stizenb.) Arnold - 5 (AIT).

B. illudens (Nyl.) Lyngby - 18 (?), 24, 26, 42 (AT, PD).

B. microcarpa (Th. Fr.) Lettau = *Mycobilimbia microcarpa*.

B. pallens (Kullh.) Zahlbr. = *Biatora pallens*.

B. sphaeroides (Dicks.) Zahlbr. = *Biatora sphaeroides* (Dicks.) Körb.

B. subfuscata (Nyl.) Th. Fr. Syn.? *Bilimbia subfuscata* (Nyl.) Th. Fr. - 30, 42 (?) (AT, PD).

B. xylophila Malme - 14, 23, 24, 32 (TT - AT/PD).

BAEOMYCES carneus Flörke - 1 - 3, 5, 6, 8, 10, 12, 14, 16, 17, 19, 26, 42, 48 (NT - AIT, FT - PD).

B. placophyllus Ach. - 1 - 8, 12, 14, 16, 21, 26, 42 (NT - AIT, FT - PD).

B. roseus Pers. = *Dibaeis baeomyces*.

B. rufus (Huds.) Rebent. - 3, 4, 7, 8, 12, 15 - 19, 26, 42, 51 (NT, AIT, FT - PD).

BELLEMERIA cinereorufescens (Ach.) Clauzade & Cl. Roux - 3, 4, 48 (SA, PD).

BELONIA russula Körb. ex Nyl. - 18 (AT).

BIATORA carneoalbida (Mull. Arg.) Coppins - 21 (AT).

B. cuprea (Sommerf.) Fr. Syn. *Lecidea cuprea* Sommerf. - 8, 12, 16, 18, 26, 32 (FT - AT/PD).

B. helvola Körb. ex Hellb. Syn. *Lecidea helvola* (Körb.) Hedl. - 1 (NT).

B. pallens (Kullh.) Zahlbr. Syn. *Bacidia pallens* (Kullh.) Zahlbr. - 5 (NT).

? *B. sphaeroides* (Dicks.) Körb. Syn. *Bacidia sphaeroides* (Dicks.) Zahlbr. - 1, 2, 8, 12, 16, 18, 26, 42 (NT - AIT, FT - PD) ; misidentification of *B. carneoalbida* (?).

B. tetramera (De Not.) Coppins. Syn. *Mycobilimbia obscurata* (Sommerf.) Rehm - 5 (NT)

B. vernalis (L.) Fr. - 1 - 3, 5, 6, 8, 16, 18, 19 (NT - AIT, ST - AT).

BIATORELLA contigua N. S. Golubk. & Piin - 8, 12, 19 (ST - AT).

B. coracina (Sommerf.) Lyngby = *Sporastatia testudinea*.

B. geophana (Nyl.) Vain. = *Steinia geophana*.

B. hemisphaerica Anzi - 2 (NT); rev. J. Poelt, 1994 (LE)

B. pruinosa (Sm.) Mudd = *Sarcogyne regularis*.

BILIMBIA subfuscata (Nyl.) Th. Fr. = ? *Bacidia subfuscata*.

B. trisepta Arnold = *Micarea peliocarpa*.

BRIGANTIAEA fuscolutea (Dicks.) R. Sant. - 14 (TT).

BRODOA intestiniformis (Vill.) Goward - 4, 5, 32, 36, 47, 48 (SA, AT/PD, PD).

B. oroarctica (Krog) Goward. Syn. *Hypogymnia oroarctica* Krog - 17, 19, 21, 42, 48 (AT, PD).

BRYOCAULON divergens (Ach.) Kärnefelt - 1, 2, 4 - 8, 10, 12 - 19, 21 - 27, 30, 32, 34, 35, 42, 46, 48, 51 (NT - AIT, FT - PD).

BRYONORA castanea (Hepp) Poelt - 1 - 3, 5, 6, 8, 15, 18, 23, 26, 32, 42 (NT - AIT, ST - PD).

B. curvescens (Mudd) Poelt. Syn. *Lecanora curvescens* (Mudd) Nyl. ex Carroll - 8 (ST).

B. rhypariza (Nyl.) Poelt v. *rhypariza* - 1, 5, 21 (NT, AIT, AT).

BRYORIA bicolor (Ehrh.) Brodo & D. Hawksw. Syn. *Alectoria bicolor* (Ehrh.) Nyl. - 16 (TT).

B. chalybeiformis (L.) Brodo & D. Hawksw. - 14, 17, 18, 30, 32 (TT - AT/PD).

B. fuscescens (Gyeln.) Brodo & D. Hawksw. - 14 (cf. v. *positiva*), 18, 23, 24, 32, 34, 35, 42 (TT - PD).

B. lanestris (Ach.) Brodo & D. Hawksw. - 1 - 3, 14 (NT, TT).

B. nadvornikiana (Gyeln.) Brodo & D. Hawksw. - 14 (TT).

B. nitidula (Th. Fr.) Brodo & D. Hawksw. - 1 - 8, 12, 14 - 19, 21, 25, 26, 30, 42 (NT - AIT, FT - PD).

B. simplicior (Vain.) Brodo & D. Hawksw. - 1 - 3, 5, 14, 15 (NT, SA, TT).

BUELLIA aethalea (Ach.) Th. Fr. - 43 (PD).

? **B. alboatra** (Hoffm.) Th. Fr. - 23 (TT); misidentification of *B. epipolia* (Ach.) Mong. (?).

B. arctica Lynge - 36 (PD).

B. atrata (Sm.) Anzi = *Orphniospora moriopsis*.

B. coniops (Wahlenb. in Ach.) Th. Fr. = *Amandinea coniops*.

B. disciformis (Fr.) Mudd - 2, 3, 18, 42 (NT, AIT, AT, PD).

B. ectolechioides (Vain.) Erichsen - 5 (NT).

B. geophila (Sommerf.) Lynge - 2, 3, 5, 12 (NT - AIT, FT - TT).

B. insignis (Hepp) Th. Fr. - 1 - 6, 8, 12, 14, 19, 21, 23, 24, 26, 32, 42, 46, 48 (NT - AIT, FT - PD).

? **B. leptocline** (Flot.) A. Massal. - 36 (PD).

B. nivalis (Bagl. & Carestia) Hertel in Hafellner - 21, 23 (TT, AT).

B. papillata (Sommerf.) Tuck. - 16, 19, 26, 30, 42 (TT - PD).

B. pulverulenta (Anzi) Jatta - 21 (AT); rev. A. Nordin, 1995.

B. punctata (Hoffm.) A. Massal. = *Amandinea punctata*.

B. triphragmioides Anzi - 2, 5 (NT, AIT).

CALICIUM salicinum Pers. - 5 (NT).

C. trabinellum (Ach.) Ach. - 5 (NT).

C. viride Pers. - 5 (NT).

CALOPLACA ? *abbreviata* (Malme) Zahlbr. Syn. *C. cinnamomea* (Th. Fr.) H. Olivier **abbreviata* Malme - 23, 24, 32, 42 (TT - PD).

? *C. alcarum* Poelt - 14 (TT).

C. ammiospila (Ach.) H. Olivier. Syn. *C. cinnamomea* (Th. Fr.) H. Olivier p. p. - 3, 5, 6, 14 - 17, 19, 22 - 24, 26, 30, 32, 33, 42, 48, 49, 51 (NT - AIT, TT - PD).

C. arctica H. Magn. = *C. tirolensis*.

C. arenaria (Pers.) Müll. Arg. - 1 - 3 (NT, SA).

C. borealis (Vain.) Poelt - 14 (TT).

C. caesiorufella (Nyl.) Zahlbr. = ? *C. phaeocarpella*.

C. castellana (Räsänen) Poelt - 2 (NT); rev. J. Poelt, 1994.

C. cerina (Ehrh. ex Hedw.) Th. Fr. Syn. *C. stillicidiorum* (Vahl) Lynge - 1, 3 - 5, 8, 12, 14, 16, 17, 19, 21, 23, 26, 30, 42, 48 (NT - AIT, FT - PD).

C. cinnamomea (Th. Fr.) H. Olivier p. p. = *C. ammiospila*.

C. cinnamomea (Th. Fr.) H. Olivier **abbreviata* Malme = *C. abbreviata* (Malme) Zahlbr.

C. cinnamomea (Th. Fr.) H. Olivier ssp. *fulvo-testacea* Malme = *C. fulvotestacea* (Malme) Zahlbr.

C. epiphyta Lynge - 21, 26 (AT); (C, LE).

C. epithallina Lynge - 2, 21 (NT, AT), (C, LE).

? *C. flavorubescens* (Huds.) J. R. Laundon - 23 (TT).

C. flavovirescens (Wulfen) Dalla Torre & Sarnth. - 2 - 4 (NT, SA).

C. fraudans (Th. Fr.) H. Olivier - 14 (TT).

C. fulvotestacea (Malme) Zahlbr. Syn. *C. cinnamomea* (Th. Fr.) H. Olivier ssp. *fulvo-testacea* Malme - 23 (TT).

C. holocarpa (Hoffm.) A. E. Wade - 3, 5, 14, 23, 24, 32 (NT, TT - AT/PD).

C. jenisejensis H. Magn. - 42 (PD).

C. jungermanniae (Vahl) Th. Fr. - 3, 5, 6, 12, 14, 23, 24, 26, 42 (NT - AIT, FT - PD).

C. livida (Hepp) Jatta - 8, 26, 30 (ST - AT).

C. nivalis (Körb.) Th. Fr. - 4, 14, 32 (NT, TT - AT/PD).

C. phaeocarpella (Nyl.) Zahlbr. Syn.? *C. caesiorufella* (Nyl.) Zahlbr. - 14, 15, 17, 19, 22 (TT - AT).

C. saxicola (Hoffm.) Nordin. Syn. *Placodium murorum* (Hoffm.) DC. - 23, 29 (TT, AT).

C. sibirica H. Magn. - 14 (TT).

C. sinapisperma (Lam. & DC.) Maheu & A. Gillet - 1, 2, 4, 5, 16, 18, 24, 42 (NT, SA, TT - PD).

C. spitzbergensis H. Magn. - 3, 14 (NT, TT).

C. stillicidiorum (Vahl) Lynge = *C. cerina*.

C. subolivacea (Th. Fr.) Lynge = *C. tirolensis*.

C. tetraspora (Nyl.) H. Olivier - 2, 3, 5, 6, 8, 12, 14, 17, 19, 23, 24, 26, 42, 48 (NT - AIT, ST - PD).

C. cf. tetrasporella (Nyl.) H. Olivier - 3, 6 (NT).

C. tirolensis Zahlbr. Syn. *C. arctica* H. Magn., *C. subolivacea* (Th. Fr.) Lynge - 2, 3, 5, 8, 12, 14, 15, 17 - 19, 23, 24, 26, 42, 48, 51 (NT - AIT, FT - PD).

C. tornoënsis H. Magn. - 14, 17, 19 (TT - AT).

? *C. vitellinula* (Nyl.) H. Olivier - 32 (AT/PD).

CANDELARIA concolor (Dicks.) Stein - 1, 12 (NT, FT).

CANDELARIELLA aurella (Hoffm.) Zahlbr. - 1 - 3, 5, 6, 14 (cf.), 23, 38, 42 (NT - AIT, TT - PD).

C. hudsonica Hakul. - 12 (FT + TT).

C. kuusamoënsis Räsänen - 1, 2, 4, 5 (NT - AIT).

C. placodizans (Nyl.) H. Magn. - 1, 2, 4 - 6, 8, 12, 21 (NT - AIT, FT - AT); reports from the Putorana Plateau (1 - 6) need confirmation, many of them have been revised by J. Poelt (1994) as *C. vitellina*.

C. terrigena Räsänen - 8, 12, 26, 42 (FT - PD).

C. vitellina (Hoffm.) Müll. Arg. - 1 - 6, 12, 14, 23, 24, 32, 36, 41, 42, 48, 49 (NT - AIT, FT - PD).

C. xanthostigma (Ach.) Lettau - 1 - 3 (NT)..

CARBONEA vorticosa (Flörke) Hertel - 32, 42, 48 (AT/PD, PD)

CATAPYRENIUM cinereum (Pers.) Körb. Syn. *Endopyrenium hepaticum* Körb. - 1 - 3, 5, 8, 18, 19, 24, 42 (NT - AIT, ST - PD).

C. daedaleum (Kremp.) Stein - 5, 14, 19 (NT, TT, AT).

C. lachneum (Ach.) R. Sant. - 1 - 3, 5, 8, 26 (NT - AIT, ST - AT).

C. squamulosum (Ach.) Breuss = *Dermatocarpella squamulosum*.

CATILLARIA atropurpurea (Schaer.) Th. Fr. = *Catinaria atropurpurea*.

C. contristans (Nyl.) Zahlbr. - 5 (NT).

C. hypochraea Vain. - 26 (AT).

C. muscicola Lynge - 1, 2, 5, 6 (NT - AIT).

C. subnegans (Nyl.) Boistel - 1, 3, 6 (NT, AIT).

CATINARIA atropurpurea (Schaer.) Vězda & Poelt. Syn. *Catillaria atropurpurea* (Schaer.) Th. Fr. - 2 (cf.), 32 (SA, AT/PD).

CATOLECHIA wahlenbergii (Ach.) Körb. - 18, 24, 32 (AT, AT/PD).

CETRARIA aculeata (Schreb.) Fr. Syn. *Coelocaulon aculeatum* (Schreb.) Link
- 1 - 7, 12, 14 - 16, 19, 21 - 24, 26, 30, 42 (NT - AIT, FT - PD).

C. andrejevii Oksner = *Arctocetraria andrejevii*.

C. ciliaris Ach. = *Tuckermannopsis ciliaris*.

C. commixta (Nyl.) Th. Fr. - 1 - 6, 21, 30, 32, 42, 48 (NT - AIT, AT/PD, PD).

C. cucullata (Bellardi) Ach. = *Flavocetraria cucullata*.

C. delisei (Schaer.) Nyl. = *Cetrariella delisei*.

? *C. ericetorum* Opiz. Syn. *C. subtubulosa* Fr. - 8, 9, 11 - 13, 16, 25, 26, 42 (FT - PD).

C. fastigiata (Delise ex Nyl. in Norrl.) Kärnefelt = *Cetrariella fastigiata*.

C. hepatizon (Ach.) Vain. - 1 - 7, 14, 17 - 19, 21, 30, 32, 36, 42, 48 (SA, TT - PD).

C. inermis (Nyl.) Krog - 3 (cf.), 7, 8, 30, 48 (SA, ST - PD).

C. islandica (L.) Ach. - 1 - 10, 12 - 19, 21, 22 - 28, 30, 34, 35, 37, 42, 46, 48 - 51 (NT - AIT, FT - PD).

C. juniperina (L.) Ach. = *Vulpicida juniperinus*.

"*C. lacunosa* Ach." - 28 (AT).

C. laevigata Rass. - 1 - 3, 5 - 8, 10, 12, 14 (?), 16, 26, 42 (NT - AIT, FT - PD).

C. muricata (Ach.) Eckfeldt. Syn. *Coelocaulon muricatum* (Ach.) J. R. Laundon - 1, 2, 4, 8, 30 (NT - AIT, ST - AT)

C. nigricans Nyl. - 1 - 6, 8, 12, 14, 16 - 18, 21, 30, 32, 34, 35, 42 (NT - AIT, FT - PD).

C. nigricans (Nyl. in Kihlm.) Elenkin = *Arctocetraria nigricans*.

C. nivalis (L.) Ach. = *Flavocetraria nivalis*.

C. odontella (Ach.) Ach. - 1 - 8, 12, 14, 17 (NT - AIT, ST - AT).

C. pinastri (Scop.) Gray = *Vulpicida pinastri*.

C. sepincola (Ehrh.) Ach. = *Tuckermannopsis sepincola*.

C. subtubulosa Fr. = *C. ericetorum* Opiz ssp. *ericetorum*.

C. tilesii Ach. = *Vulpicida tilesii*.

CETRARIELLA delisei (Schaer.) Kärnefelt & Thell. Syn. *Cetraria delisei* (Schaer.) Nyl. - 1 - 8, 12, 14 - 19, 21, - 26, 28, 30, 33, 34, 35, 37, 42, 46, 48 - 50 (NT - AIT, ST - PD).

C. fastigiata (Delise ex Nyl. in Norrl.) Kärnefelt & Thell. Syn. *Cetraria fastigiata* (Delise ex Nyl. in Norrl.) Kärnefelt - 8, 14, 15, 17 - 19, 21, 22, 25, 26, 30, 37, 49, 51 (ST - PD)

CHAENOTHECA chrysocephala (Ach.) Th. Fr. - 5 (NT).

C. ferruginea (Ach.) Mig. - 5 (NT).

C. furfuracea (L.) Tibell - 5 (NT).

C. gracillima (Vain.) Tibell - 5 (NT).

C. trichialis (Ach.) Th. Fr. - 5 (NT).

CHAENOTHECOPSIS nana Tibell - 5 (NT).

C. pusilla (Ach.) A. F. W. Schmidt - 5 (NT).

C. viridialba (Kremp.) A. F. W. Schmidt - 5 (NT).

CHROMATOCHLAMYS muscorum (Fr.) H. Mayrhofer & Poelt. Syn.
Microglaena muscorum (Fr.) Th. Fr. - 1, 2, 5, 6, 19 (NT, AIT, AT).

CHRYSOTHRIX chlorina (Ach.) J. R. Laundon - 1 - 3 (NT, SA).

CLADINA arbuscula (Wallr.) Hale & W. L. Culb. s. lat. - 1 - 8, 10, 11, 13
- 15, 17 - 19, 21, 23, 25 - 28, 30, 32, 34, 35 (NT - AIT, FT -
AT/PD).

C. arbuscula (Wallr.) Hale & W. L. Culb. ssp. *beringiana* (Ahti) N. S. Golubk.
Syn. *C. beringiana* (Ahti) Trass - 12, 16, 42 (FT - PD).

C. beringiana (Ahti) Trass = *C. arbuscula* ssp. *beringiana*.

C. mitis (Sandst.) Hustich - 3, 5, 9, 14 (NT, SA, FT/ST - TT).

C. rangiferina (L.) Nyl. - 1 - 19, 21, 25, 26, 30, 32, 34, 35, 42, 46 (NT - AIT,
FT - PD).

C. stellaris (Opiz) Brodo - 1 - 3, 5, 6, 8, 9, 11 - 13, 15 (NT - AIT, FT -
TT).

C. stygia (Fr.) Ahti - 7, 14, 15, 17, 30 (ST - AT).

CLADONIA acuminata (Ach.) Norrl. - 1 - 3, 5 - 8, 12, 14, 25 (NT - AIT,
FT - AT).

C. alaskana A. Evans - 1, 7, 14 (AIT, ST, TT); rev. T. Ahti, 1993 (H, LE).

C. amaurocraea (Flörke) Schaer. - 1 - 3, 5 - 19, 21, 22, 25, 26, 30, 42 (NT
- AIT, FT - PD).

C. bacillaris (Leight.) Arnold = *C. macilenta*.

C. bacilliformis (Nyl.) Glück - 3, 5, 7, 14 (NT, ST, TT).

C. bellidiflora (Ach.) Schaer. - 1, 5, 14 - 18, 24, 30, 32, 33, 34, 35 (NT, TT
- AT/PD).

C. borealis S. Stenroos. Syn. *C. coccifera* (L.) Will. v. *stematina* (Ach.) Vain.
- 7, 14, 15, 33 (ST - AT/PD); specimens from 7, 14, 15 rev. T. Ahti,
1993 (H, LE).

C. botrytes (K. G. Hagen) Willd. - 1, 3, 5 (NT).

C. cariosa (Ach.) Spreng. - 1 - 3, 5, 7, 8, 12, 14, 17, 26 (NT - AIT, FT -
AT).

C. carneola (Fr.) Fr. - 8 (ST).

C. cenotea (Ach.) Schaer. - 1, 3 - 5, 8, 14, 16 (NT, SA, ST, TT).

C. cervicornis (Ach.) Flot. ssp. *verticillata* (Hoffm.) Ahti. Syn. *C. verticillata*
(Hoffm.) Schaer. - 1 - 7, 12, 14, 17, 21 (NT - AIT, FT - AT/PD)

C. chlorophaea (Flörke ex Sommerf.) Spreng. - 1 - 3, 5 - 8, 12, 14, 16, 17,
19, 21, 25, 26, 42, 48 (NT - AIT, FT - PD).

- C. coccifera* (L.) Willd. s. lat. - 1 - 8, 10, 12, 14, 15, 17 - 19, 21, 22, 25, 26, 30, 32, 42, 46 (NT - AIT, FT - PD).
- C. coccifera* (L.) Willd. v. *stematina* (Ach.) Vain. = *C. borealis*.
- C. coniocraea* (Flörke) Spreng. - 1 - 3, 16 (NT, SA, TT).
- C. cornuta* (L.) Hoffm. - 1 - 3, 5, 7, 8, 12, 14 - 16 (NT, SA, FT - TT).
- C. crispata* (Ach.) Flot. - 3, 16 (NT, SA, TT).
- C. cyanipes* (Sommerf.) Nyl. - 1, 3, 7, 8, 14, 15, 17 (NT, SA, ST - AT).
- C. dahliana* Kristinsson - 12 (FT + TT).
- C. decorticata* (Flörke) Spreng. - 2 - 6 (NT - AIT).
- C. deformis* (L.) Hoffm. - 1 - 3, 5, 8, 10, 14, 16, 32 (NT, SA, ST - AT/PD).
- C. digitata* (L.) Hoffm. - 1 - 3, 5 (NT).
- C. ecmocyna* Leight. - 1 - 7, 21, 22 (NT - AIT, ST - AT).
- C. fimbriata* (L.) Fr. - 1 - 5, 7, 8, 14, 16, 17 (NT, SA, ST - AT).
- C. floerkeana* (Fr.) Flörke - 2 (NT).
- C. furcata* (Huds.) Schrad. - 1, 8, 14, 16, 18, 19 (NT, ST - AT).
- C. gracilis* (L.) Willd. s. lat. - 1 - 3, 5, 6, 8 - 13, 16, 18, 22, 23, 26, 28, 30, 32 - 35, 42, 49 (NT - AIT, FT - PD).
- C. gracilis* ssp. *elongata* (Wulfen) Vain. - 7, 14, 15, 17 - 19, 27 (ST - AT).
- ? *C. libifera* Savicz - 8 (ST).
- C. luteoalba* Wheldon & A. Wilson - 8 (ST).
- C. macilenta* Hoffm. Syn. *C. bacillaris* (Leight.) Arnold - 1 - 3, 5 (NT, SA).
- C. macroceras* (Delise) Hav. - 7, 8, 12, 14 - 16, 18, 19, 22, 25, 26, 30, 42, 46, 49 (FT - PD).
- C. macrophylla* (Schaer.) Stenh. - 1 - 3, 5 - 7, 12, 14, 15, 17 - 19, 48 (cf.) (NT, ST - PD).
- C. maxima* (Asahina) Ahti - 8 (ST).
- C. merochlorophaea* Asahina - 14 (cf.), 15 (cf.) (TT).
- C. ochrochlora* Flörke - 2 (NT).
- C. phyllophora* Hoffm. - 1 - 3, 5, 8, 14 - 16, 21 (cf.), 46, 48, 49 (NT - AIT, ST - PD).
- C. pleurota* (Flörke) Schaer. - 1 - 3, 5, 7, 8, 12, 14, 16 - 19, 26 (NT, SA, FT - AT).
- C. pocillum* (Ach.) Grognot - 1 - 4, 7, 8, 12, 14, 16, 17, 19, 21, 23, 26, 42, 48, 49, 51 (NT - AIT, FT - PD).
- C. pyxidata* (L.) Hoffm. - 1 - 8, 10 - 12, 14 - 17, 18, 19, 21, 22, 24 - 27, 30, 42, 48, 49, 51 (NT - AIT, FT - PD).
- C. squamosa* Hoffm. - 1, 2, 7, 8, 14, 15 - 19 (NT, ST - AT).
- C. stricta* (Nyl.) Nyl. - 1 - 8, 12, 14, 15, 17 - 19, 21, 22, 25, 26, 27, 42, 48 (NT - AIT, FT - PD).
- C. subfurcata* (Nyl.) Arnold - 1, 4, 8, 14, 15, 17, 18 (NT, AIT, ST - AT).
- C. subulata* (L.) Weber ex F. H. Wigg. - 1 - 3, 16 (NT, TT).
- C. sulphurina* (Michx.) Fr. - 1 - 3, 12, 14, 19 (NT, TT, AT).
- C. symphycarpa* (Flörke) Fr. - 7, 8, 19, 26, 42 (ST - PD).
- C. thomsonii* Ahti - 25, 26 (AT).

C. uncialis (L.) Weber ex Wigg. - 1 - 3, 5 - 8, 10, 12, 14, 15 - 19, 21, 24, 25, 26, 32, 34, 35, 42 (NT - AIT, FT - PD).

C. verticillata (Hoffm.) Schaer. = *C. cervicornis* ssp. *verticillata*.

COELOCAULON aculeatum (Schreb.) Link = *Cetraria aculeata*.

C. muricatum (Ach.) J. R. Laundon = *Cetraria muricata*.

COLLEMA arcticum Lyng = *C. ceraniscum*.

C. ceraniscum Nyl. Syn. *C. arcticum* Lyng = 1 - 3, 8, 12, 23, 26, 42, 48, 51 (NT - AIT, FT - PD).

C. crispum (Huds.) Weber ex Wigg. - 26 (AT).

C. cristatum (L.) Weber ex Wigg. - 26 (AT).

C. dichotomum (With.) Coppins & J. R. Laundon - 3 (SA).

C. flaccidum (Ach.) Ach. - 24, 42 (?) (AT, PD).

C. fuscovirens (With.) J. R. Laundon - 1 - 3, 5, 6 (NT - AIT).

C. cf. minor (Pakh.) Tomin - 1 - 3 (NT, SA).

C. polycarpon Hoffm. - 1, 5, 21 (SA, AIT, AT).

C. tenax (Sw.) Ach. - 1 - 3, 5, 8, 12, 16, 26, 42 (NT - AIT, FT - PD).

CORISCIMUM viride (Ach.) Vain. = *Omphalina hudsoniana*.

CYPHELIUM karelicum (Vain.) Räsänen - 5 (NT).

C. pinicola Tibell - 2 (NT, NT/SA); rev. J. Poelt, 1994 (LE).

C. tigillare (Ach.) Ach. - 2, 5 (NT).

DACTYLINA arctica (M. J. Richardson) Nyl. - 1 - 3, 5 - 10, 12 - 19, 21, 23 - 28, 30, 32, 34, 35, 42, 46, 48 (NT - AIT, FT - PD).

D. beringica C.D.Bird & J. W. Thomson - 14 (cf.), 26 (Thomson & Bird 1978:1614) (TT, AT).

D. madreporiformis (Ach.) Tuck. - 16, 21, 23, 24, 42, 48, 49, 51 (TT - PD).

D. ramulosa (Hook.) Tuck. - 1 - 3, 5 - 8, 12, 14, 16 - 19, 21, 25, 26, 30, 42, 45, 46, 48, 49, 51 (NT - AIT, FT - PD).

DERMATOCARPELLA squamulosum (Ach.) Harada. Syn. *Catapyrenium squamulosum* (Ach.) Breuss - 2 (NT).

DERMATOCARPON intestiniforme (Körb.) Hasse - 1, 3 - 5, 21 (NT - AIT, AT).

D. luridum (With.) J. R. Laundon - 1 (NT, SA).

D. miniatum (L.) W. Mann - 1 - 6 (NT - AIT).

D. rivulorum (Arnold) Dalla Torre & Sarnth. - 1, 5 (NT - AIT).

D. vellereum Zschacke v. *vellereum* - 1, 3, 6 (NT, SA); confirm. J. Poelt, 1994 (GZU, LE).

DIBAEIS baeomyces (L. fil.) Rambold & Hertel. Syn. *Baeomyces roseus* Pers. - 5, 8, 12, 26, 46, 48 (NT, FT - PD).

DIPLOSCHISTES muscorum (Scop.) R. Sant. - 1 - 3, 5, 14 (NT - AIT, TT).

D. scruposus (Schreb.) Norman - 2 - 4, 6 (NT, SA).

EIGLERA flavida (Hepp) Hafellner Syn. *Lecanora flavida* Hepp - 38, 42 (PD).

ENDOCARPON pusillum Hedw. - 1 - 3 (NT - AIT).

ENDOPYRENIUM hepaticum Körb. = *Catapyrenium cinereum*.

EPILICHEN scabrosus (Ach.) Clem. - 1, 2, 4 - 6, 8, 12, 19, 26, 42 (NT - AIT, FT - PD).

EUOPSIS granatina (Sommerf.) Nyl. - 18 (AT).

E. pulvinata (Schaer.) Vain. - 1, 3, 5, 8, 12, 21, 42 (NT - AT, FT - PD).

EVERNIA mesomorpha Nyl. - 2, 3, 5, 8, 14 (NT, ST, TT).

E. perfragilis Llano - 1, 2, 21 (NT - AIT, AT).

FARNOLDIA jurana (Schaer.) Hertel - 5, 23 (NT, TT).

FLAVOCETRARIA cucullata (Bellardi) Kärnefelt & Thell. Syn. *Cetraria cucullata* (Bellardi) Ach. - 1 - 19, 21 - 24, 26, 27, 30, 34, 35, 37, 42, 46, 48 - 51 (NT - AIT, FT - PD).

F. nivalis (L.) Kärnefelt & Thell. Syn. *Cetraria nivalis* (L.) Ach. - 1 - 8, 10 - 19, 21, 23, 25 - 28, 30, 32, 34, 35, 37, 42, 49 - 51 (NT - AIT, FT - PD).

FORAMINELLA ambigua (Wulfen) S. L. F. Mey. = *Parmeliopsis ambigua*.

F. hyperopta (Ach.) S. L. F. Mey. = *Parmeliopsis hyperopta*.

FULGENSIA bracteata (Hoffm.) Räsänen - 19, 21, 24 [incl. v. *alpina* (Th. Fr.) Räsänen], 32, 42, 51 (AT, PD).

GYALECTA arctica Malme = *Gyalidea scutellaris*.

G. foveolaris (Ach.) Schaer. - 2, 8, 12, 18, 23, 24, 26 (NT, FT - AT).

G. geioica (Wahlenb.) Ach. - 12, 26 (FT - AT).

G. cf. kukriensis (Räsänen) Räsänen - 21 (AT); on bryophytes and soil! (LE, UPS).

G. peziza (Mont.) Anzi - 2 (cf.), 12, 19 (AIT, TT, AT).

- GYALIDEA** *scutellaris* (Bagl. & Carestia) Lettau. Syn. *Gyalecta arctica* Malme - 32 (AT/PD).
- GYSOPLACA** sp. - 21 (AT); on soil, mainly in limestone rocks; sterile specimens with characteristic blastidia; rev. E. Timdal, 1995 (LE, O, UPS).
- HAEMATOMMA** *ventosum* (L.) A. Massal. = *Ophioparma ventosa*.
- HAFELLNERA** *parasemella* (Nyl.) Houmeau & Cl. Roux. Syn. *Lecidella parasemella* Nyl. - 1 - 3, 12, 14 (NT - AIT, FT, TT).
- HELOCARPON** *crassipes* Th. Fr. = *Micarea crassipes*.
- HEPPIA** *lutosa* (Ach.) Nyl. - 2 (NT, SA).
- HUILIA** *flavocaulerescens* auct. = *Porpidia melinodes*.
- HYMENELIA** *lacustris* (With.) M. Choisy - 4, 32, 42 (NT, AT/PD, PD).
- HYPOCENOMYCE** *scalaris* (Ach. ex Lilj.) M. Choisy - 2, 3, 5 (NT, SA).
- HYPOGYMNIA** *austerodes* (Nyl.) Räsänen - 1 - 7, 12, 14, 16 (NT - AIT, FT - TT).
- H. bitteri** (Lyngé) Ahti - 1 - 3, 5, 16 (NT, SA, TT).
- H. oroarctica** Krog = *Brodoa oroarctica*.
- H. physodes** (L.) Nyl. - 1 - 8, 12, 14, 15, 18, 21, 26, 32 (NT - AIT, FT - AT/PD).
- H. subobscura** (Vain.) Poelt - 2 - 5, 8, 12, 14, 16 - 19, 21, 23, 26, 30, 42, 46, 48 (NT - AIT, FT - PD).
- H. vittata** (Ach.) Parrique - 2, 3, 5, 6, 17, 19, 30 (NT, SA, AT).
- ICMADOPHILA** *ericetorum* (L.) Zahlbr. - 1, 2, 5, 8, 12 (NT, FT - ST).
- IMMERSARIA** *athrocarpa* (Ach.) Rambold & Pietschm. - 3 (SA); det. J. Poelt, 1994.
- IMSHAUGIA** *aleurites* (Ach.) Š. L. F. Mey. Syn. *Parmeliopsis aleurites* (Ach.) Nyl. - 1 - 3, 5 (NT)
- IONASPIS** *cyanocarpa* (Anzi) Jatta - 1 (NT).
- I. epulotica** (Ach.) Arnold - 1 (NT).
- I. rhodopis** (Sommerf.) Blomb. & Forssell - 42 (PD).

JAPEWIA tornoënsis (Nyl.) Tønsberg. Syn. *Lecidea tornoënsis* Nyl. - 1 - 6, 8, 12, 14 - 16, 21, 22, 26, 30, 32, 34, 35, 42, 46, 48, 51, 52 (NT - AIT, FT - PD).

LECANIA cyrtella (Ach.) Th. Fr. - 1 - 3, 5 (NT).

LECANORA albescens (Hoffm.) Branth & Rostr. - 4, 5, 36 (f. *deminuta* Stenh.) (NT, SA, PD).

L. allophana Nyl. - 2, 14 (cf.) (NT, TT).

L. anopta Nyl. - 42 (PD).

L. anseris Lyng = *Aspicilia anseris*.

L. argentata (Ach.) Malme - 1, 3 (NT).

L. atrosulphurea (Wahlenb.) Ach. - 5, 6, 14, 18, 23, 24, 32, 36, 41, 48 (AIT, TT - PD).

L. beringii Nyl. = ? *L. hagenii* v. *saxifragae*.

L. bicincta Ramond - 4, 5 (NT - AIT).

L. boligera (Norman ex Th. Fr.) Hedl. - 14 (TT).

L. campestris (Schaer.) Hue - 3 - 5 (SA).

L. cenisia Ach. - 1, 5, 6 (NT - AIT).

L. chlorophaeodes Nyl. - 4, 6 (NT).

L. contractula Nyl. s. lat. - 14 (TT).

L. contractula v. *feracissima* (Th. Fr.) Vain. = *Arctopeltis thuleana*.

L. crenulata Hook. - 4 - 6 (NT).

L. curvescens (Th. Fr.) Arnold = *Bryonora curvescens*.

L. dispersa (Pers.) Sommerf. - 2 - 6, 15 (cf.), 21 (on sandy soil, LE), 23 (NT, TT, AT).

L. epibryon (Ach.) Ach. - 1, 2, 5, 8, 10, 12, 16, 21, 23, 24, 26, 42, 48, 49, 51 (NT - AIT, FT - PD).

L. expallens Ach. - 2, 3 (NT).

L. flavida Hepp = *Eiglera flavida*.

L. frustulosa (Dicks.) Ach. - 3 - 5, 14, 17, 52 (NT, SA, TT - PD).

L. fuscescens (Sommerf.) Nyl. - 1, 2, 5 (NT, SA).

L. geophila (Th. Fr.) Poelt - 19, 21, 24 (?) (AT); (GZU, LE, UPS).

L. gyrophorina Poelt & Zhurb. nomen nudum (Poelt & Zhurbenko 1994) - 2, 5 (NT/SA, SA); (GZU, LE).

L. hagenii (Ach.) Ach. s.l. - 1, 2, 5, 23 (NT, SA, TT).

L. hagenii v. *saxifragae* (Anzi). Syn.(?) *L. beringii* Nyl. - 2 - 5, 19, 21, 23, 48 (NT - AIT, TT - PD).

L. intricata (Ach.) Ach. - 4, 5, 48 (NT - AIT, PD).

L. marginata (Schaer.) Hertel & Rambold. Syn. *Lecidea marginata* Schaer. - 3 (SA).

L. mughicola Nyl. - 2 (SA); rev. J. Poelt, 1994 (LE).

L. nephaea Sommerf. = *Protoparmelia nephaea*.

L. orae-frigidae R. Sant. - 14, 15, 30 (TT - AT).

- L. perradiata* Nyl. = *Aspicilia perradiata*.
L. polytropa (Hoffm.) Rabenh. - 3 - 6, 21, 24, 32, 38, 41 - 43, 47, 48, 52
 (NT - AIT, AT, PD).
L. proserpens Nyl. = *L. rosulata*.
L. pulicaris (Pers.) Ach. - 1, 3, 5 (NT, SA).
L. rosulata (Körb.) Stizenb. Syn. *L. proserpens* Nyl. - 36, 42 (PD).
L. rupicola (L.) Zahlbr. - 5, 14, 17, 18 (NT, TT, AT).
L. saligna (Schrad.) Zahlbr. - 1 - 3 (NT, SA).
L. straminea Ach. - 32 (AT/PD).
"L. subfusca (L.) Ach." - 18, 24, 42 (AT, PD).
L. subintricata (Nyl.) Th. Fr. - 2 (NT).
L. submellea Savicz - 12 (FT).
L. subrugosa Nyl. - 1, 2, 5 (NT).
L. sulphurea (Hoffm.) Ach. - 21 (AT).
L. torrida Vain. - 42 (PD).
L. varia (Hoffm.) Ach. - 18, 23, 24, 32 (TT - AT/PD).
L. vegae Malme - 32 (AT/PD).

- LECIDEA** cf. *albohyalina* (Nyl.) Th. Fr. - 3 (NT).
L. arctogena (Th. Fr.) H. Olivier = *Tephromela testaceoatra*.
L. atrobrunnea (Ramond ex Lam. & DC.) Schaer. - 17, 42 (AT - PD).
L. atrofusca (Hepp) Mudd = *Mycobilimbia hypnorum*.
L. auriculata Th. Fr. - 24, 32 (AT, AT/PD).
L. berengeriana (A. Massal.) Nyl. = *Mycobilimbia berengeriana*.
L. botryosa (Fr.) Th. Fr. - 2, 3, 5 (NT).
L. brachyspora (Th. Fr.) Nyl. v. *chatangensis* Malme - 23 (TT).
L. caesioatra Schaer. - 32 (AT/PD).
L. confluens (Weber) Ach. - 3, 42, 48 (SA, PD).
L. cuprea Sommerf. = *Biatora cuprea*.
L. diducens Nyl. - 36, 44 (PD).
L. ementiens Nyl. - 5 (cf.), 8, 12, 26, 42, 49 (AIT, FT - PD).
L. epiphaea Nyl. - 3, 8, 26, 42 (SA, ST - PD).
L. epixanthoidiza Nyl. - 2, 3, 5 (NT - AIT).
L. fallax (Hepp) Linds. - 8 (ST).
L. garovaglii Schaer. = *Miriquidica garovaglii*.
L. goniophila Flörke = *Lecidella stigmatea*.
L. gorodkovii Oksner - 8 (ST).
L. helvola (Körb. ex Hellb.) Hedl. = *Biatora helvola*.
L. hypnorum Lib. = *Mycobilimbia hypnorum*.
L. hypopta Ach. - 2, 3, 5 (NT, SA).
L. instrata Nyl. = *Miriquidica instrata*.
L. lactea Flörke ex Schaer. = *L. lapicida*.
L. lapicida (Ach.) Ach. - 5, 32, 39, 44, 47, 48, 49 (NT, AT/PD, PD).
L. limosa Ach. - 6 (AIT).

L. lurida (Ach.) DC. Syn. *Psora lurida* (Ach.) DC. - 42 (PD).

"*L. macrocarpa* f. *praetoria* Th. Fr." - 32 (AT/PD).

L. marginata Schaer. = *Lecanora marginata*.

L. cf. miscella Ach. non Sommerf. - 6 (AIT).

L. pallida Th. Fr. = *Pilophorus dovrensis*.

L. phaeops Nyl. Syn. *Aspicilia phaeops* (Nyl.) Stein - 48 (PD).

L. ramulosa Th. Fr. - 1, 2, 5, 15, 22, 23, 26, 30, 42, 46, 51 (NT - AIT, TT - PD).

L. recessa H. Magn. - 48 (PD).

L. septentrionalis Th. Fr. - 2 (AIT).

L. subcandida H. Magn. - 4 (cf.), 8, 12, 16, 18 (AIT, FT - AT).

L. sublimosa Nyl. - 8, 22 (cf.), 24, 26, 30 (cf.), 32, 42 (ST - AT).

L. tajmyrensis Malme - 32 (AT/PD).

L. tessellata Flörke - 3 (SA).

L. tornoënsis Nyl. = *Japewia tornoënsis*.

L. turficola (Hellb.) Th. Fr. - 2, 5 (NT).

L. cf. turgidula Fr. - 2 (NT).

LECIDELLA *carpathica* Körb. - 3 (SA).

L. elaeochroma (Ach.) M. Choisy - 1 - 3, 5, 14 (NT, TT).

L. euphorea (Flörke) Hertel. Syn. *L. glomerulosa* (DC.) Steud.? - 1 - 3, 5, 14, 23, 25, 32, 42 (NT, TT - PD).

L. glomerulosa (DC.) Steud.? = *L. euphorea*.

L. parasemella Nyl. = *Hafellnera parasemella*.

L. stigmatea (Ach.) Hertel & Leuckert - Syn. *Lecidea goniophila* Flörke - 3, 24, 32, 36, 38, 48 (SA, AT, PD).

L. wulfenii (Hepp) Körb. - 1 - 3, 5, 6, 8, 12, 26 (NT - AIT, FT - AT).

LECIDOMA *demissum* (Rutstr.) Gotth. Schneider & Hertel - 1, 2, 4 - 6, 8, 12, 21, 24, 26, 32, 34, 35 (NT - AIT, FT - AT/PD).

LECIOPHYSMA *finmarkicum* Th. Fr. - 1, 2, 8, 12, 21, 23, 26, 42, 46, 48 (NT - AIT, FT - PD).

LEPRARIA *arctica* (Lynge) Wetmore = *Leproloma vouauxii*.

L. membranacea (Dicks.) Vain. = *Leproloma membranaceum*.

L. neglecta (Nyl.) Lettau - 30, 51 (AT, PD).

LEPROLOMA *membranaceum* (Dicks.) J. R. Laundon. Syn. *Lepraria membranacea* (Dicks.) Vain. - 48, 49, 52 (PD).

L. vouauxii (Hue) J. R. Laundon. Syn. *Lepraria arctica* (Lynge) Wetmore - 12, 26, 42 (TT - PD).

LEPTOGIUM *arcticum* M. Jørg. - 8, 26, 48 (ST - PD).

L. crenatulum (Nyl.) Vain. - 8 (?) (ST).

L. gelatinosum (With.) J. R. Laundon. Syn. *L. sinuatum* (Huds.) A. Massal. - 1 - 3, 8, 12, 16, 26, 42, 48 (SA, AIT, ST - PD).

L. lichenoides (L.) Zahlbr. - 2, 3, 8, 12, 16, 26, 42 (NT - AIT, FT - PD).

L. saturninum (Dicks.) Nyl. - 2, 3, 8, 12, 16, 19, 21, 26 (NT, FT - AT/PD).

L. sinuatum (Huds.) A. Massal. = *L. gelatinosum*.

L. subtile (Schrad.) Torss. - 2 (cf.) (NT).

L. tenuissimum (Dicks.) Körb. - 12, 18, 23 (FT - AT).

LOBARIA linita (Ach.) Rabenh. - 14 - 19, 21, 22, 24 - 26, 30 (TT, AT).

LOBOTHALLIA alphoplaca (Wahlenb. in Ach.) Hafellner. Syn. *Aspicilia alphoplaca* (Wahlenb. in Ach.) Poelt & Leuckert - 1 - 6, 49 (NT - AIT, PD).

L. melanaspis (Ach.) Hafellner. Syn. *Aspicilia melanaspis* (Ach.) Poelt & Leuckert - 1 - 6, 14, 17, 19, 32 (NT - AIT, TT - AT/PD).

L. radiosa (Hoffm.) Hafellner. Syn. *Placodium circinatum* (Pers.) Gray - 23 (?), 42 (TT - PD).

LOPADIUM coralloideum (Nyl.) Lynge - 2, 3, 5, 8, 12, 14 - 16, 22, 25, 26, 42 (NT, SA, FT - PD).

L. fecundum Th.Fr. = *Schadonia fecunda*.

L. pezizoideum (Ach.) Körb. - 1 - 3, 5, 6, 8, 10, 12, 16, 18, 19, 25, 26, 32, 42, 48 (NT - AIT, FT - PD).

MEGASPORA verrucosa (Ach.) Hafellner & V. Wirth. Syn. *Pachyospora verrucosa* (Ach.) A. Massal. - 1 - 6, 8, 12, 16, 18, 19, 21, 23, 24, 26, 42 (NT - AIT, FT - PD).

MELANELIA disjuncta (Erichsen) Essl. Syn. *Parmelia disjuncta* Erichsen - 1 - 7, 14, 17, 18, 21 (NT - AIT, ST - AT/PD).

M. infumata (Nyl.) Essl. - 1 - 3, 5, 12, 14, 16, 17, 21, 48, 49 (NT - AIT, TT - PD).

M. olivacea (L.) Essl. - 1 - 3, 5, 6, 14, 18 (NT, SA, TT, AT).

M. panniformis (Nyl.) Essl. - 1 - 7, 14, 17, 18 (NT - AIT, ST - AT).

M. septentrionalis (Lynge) Essl. - 1, 3, 5 - 7, 14, 15 (cf.) (NT, SA, ST, TT).

M. sorediata (Ach.) Goward & Ahti - 1 - 3, 5 - 7, 14 (NT - AIT, ST, TT).

M. stygia (L.) Essl. Syn. *P. stygia* (L.) Ach., *P. teretiuscula* Oksner - 1 - 6, 14, 17 - 19, 21, 24, 47, 48 (NT - AIT, TT - PD).

M. tominii (Oksner) Essl. Syn. *Parmelia tominii* Oksner, *P. substygia* Räsänen - 1 - 3, 5, 14, 17, 21 (NT, AIT, TT - AT/PD).

MICAREA assimilata (Nyl.) Coppins - 1, 3, 5, 8, 16, 22, 26, 32 (v. *infusata* Th. Fr.), 49 (NT - AIT, ST - PD).

M. cf. crassipes (Th. Fr.) Coppins. Syn. *Helocarpon crassipes* Th. Fr. - 1, 5 (NT, SA).

M. incrassata Hedl. - 48 (PD).

M. melaena (Nyl.) Hedl. - 1, 3, 5 (NT).

M. osloënsis (Th. Fr.) Hedl. - 2 (cf.), 16 (AIT, TT).

M. peliocarpa (Anzi) Coppins & R. Sant. Syn. *Bilimbina trisepta* Arnold - 40, 42 (PD).

M. turfosa (A. Massal.) Du Rietz - 4 (NT, SA).

MICROCALICIUM parietinum (Ach. ex Schaer.) D. Hawksw. = *Mycocalicium parietinum*.

MICROGLAENA leucothelia (Anzi) Arnold = *Protothelenella leucothelia*.

M. muscorum (Fr.) Th. Fr. = *Chromatochlamys muscorum*.

M. reducta (Th. Fr.) Hellb. = *Protothelenella sphinctrinoidella*.

MIRIQUIDICA garovaglii (Schaer.) Hertel & Rambold. Syn. *Lecidea garovaglii* Schaer. - 5 (NT).

M. instrata (Nyl.) Hertel & Rambold. Syn. *Lecidea instrata* Nyl. - 5 (NT).

M. lulensis (Hellb.) Hertel & Rambold - 36, 38, 44, 47, 48 (PD).

MYCOBILIMBIA berengeriana (A. Massal.) Hafellner & V. Wirth. Syn. *Lecidea berengeriana* (A. Massal.) Nyl. - 1, 2, 5, 8, 12, 16, 18, 22, 26, 30, 51 (cf.) (NT - AIT, ST - PD).

M. hypnorum (Lib.) Kalb & Hafellner. Syn. *Lecidea hypnorum* Lib., *L. atrofusca* (Hepp) Mudd - 1 - 6, 8, 12, 18, 21, 24, 32, 35, 42, 51 (NT - AIT, FT - PD).

M. lobulata (Sommerf.) Hafellner. Syn. *Toninia lobulata* (Sommerf.) Lynge - 5, 8, 10, 12, 16, 18, 19, 21, 23, 24, 26, 42 (NT/SA, FT - PD).

M. microcarpa (Th. Fr.) Brunnb. Syn. *Bacidia microcarpa* (Th. Fr.) Lettau - 2, 8, 12, 16, 23, 26 (SA, AIT, FT - AT).

M. obscurata (Sommerf.) Rehm = *Biatora tetramera*.

M. sabuletorum (Schreb.) Hafellner - 2, 51 (NT, PD).

MYCOBLASTUS affinis (Schaer.) T. Schauer - 25 (AT).

M. alpinus (Fr.) Kernst. - 8, 12, 26 (FT - AT).

M. sanguinarius (L.) Norman - 1, 2, 5, 14, 24 (NT, SA, TT, AT).

MYCOCALICIUM subtile (Pers.) Szatala. Syn. *Microcalicium parietinum* (Ach.) D. Hawksw. - 5 (NT).

NEOFUSCELIA pulla (Ach.) Essl. Syn. *Parmelia pulla* Ach. - 1 (AIT).

NEPHROMA arcticum (L.) Torss. - 5, 6, 8, 10, 12, 14, 15, 18, 19, 21, 25 - 28, 34, 35 (SA, FT - AT/PD).

N. expallidum (Nyl.) Nyl. - 1 - 3, 5 - 8, 12, 14, 15, 17, 19, 21, 23, 25, 26, 42 (NT - AIT, FT - PD).

N. parile (Ach.) Ach. - 3 (SA).

N. resupinatum (L.) Ach. - 2, 3, 23 (NT, TT).

NORMANDINA pulchella (Borrer) Nyl. - 1 (SA).

OCHROLECHIA androgyna (Hoffm.) Arnold - 2, 3, 14, 15, 30 (cf.), 51 (NT, SA, TT - PD).

O. arborea (Kreyer) Almb. - 1 - 3 (NT, SA).

O. frigida (Sw.) Lyng. Syn. *O. gonatodes* (Ach.) Räsänen, *O. lapuënsis* (Vain.) Räsänen - 1, 2, 4 - 6, 8, 12 - 19, 21, 22, 24 - 27, 30, 32, 34, 35, 42, 46, 48, 49, 51 (NT - AIT, FT - PD).

O. gonatodes (Ach.) Räsänen = *O. frigida*.

O. grimmiae Lyng. - 14, 17, 26, 30, 32, 42, 48 (TT - PD).

O. gyalectina (Nyl.) Zahlbr. - 12, 26 (FT - AT).

O. inaequatula (Nyl.) Zahlbr. - 5, 6, 8, 16, 21, 25, 32, 34, 35 (NT, AIT, ST - AT/PD).

O. lapuënsis (Vain.) Räsänen = *O. frigida*.

O. upsaliensis (L.) A. Massal. - 1 - 3, 5, 6, 8, 12, 14, 16, 17, 19, 21, 26 (NT - AIT, FT - AT/PD).

OMPHALINA hudsoniana (H. S. Jenn.) H. E. Bigelow. Syn. *Phytoconis viridis* (Ach.) Redh. & Kuyper, *Coriscium viride* (Ach.) Vain. - 8, 14, 15 (ST, TT).

OPHIOPARMA ventosa (L.) Norman s. lat. Syn. *Haematomma ventosum* (L.) A. Massal. - 1 - 6, 21 [v. *lapponica* (Räsänen)], 28, 32 (NT - AIT, AT, AT/PD).

ORPHNIOSPORA moriopsis (A. Massal.) D. Hawksw. Syn. *Buellia atrata* (Sm.) Anzi - 36, 47 (PD).

PACHYOSPORA verrucosa (Ach.) A. Massal. = *Megaspora verrucosa*.

PANNARIA leucophaea (Vahl) M. Jørg. - 3, 21 (NT, AT).

P. pezizoides (Weber) Trevis. - 1, 2, 5 - 8, 14 - 19, 21, 22, 26, 32, 34, 35, 42, 46, 48, 49, 51 (NT - AIT, ST - PD).

P. praetermissa Nyl. in Chyd. & Furuhi. - 1 - 3, 5 - 8, 12, 14, 16, 17, 19, 26, 42 (NT - AIT, FT - PD).

PARMELIA birulae Elenkin = *Arctoparmelia separata*.

P. disjuncta Erichsen = *Melanelia disjunata*.

P. fraudans (Nyl.) Nyl. - 1 - 3, 5, 7, 8, 14, 17, 26 (NT, SA, ST - AT).

P. nigra Vain. = *Allantoparmelia sibirica*.

P. omphalodes (L.) Ach. excl. ssp. *glacialis* Skult - 1 - 8, 12, 14, 15 - 19, 21, 23, 25 - 27, 42, 46, 48, 49 (NT - AIT, ST - PD).

P. omphalodes (L.) Ach. ssp. *glacialis* Skult - 14, 15, 17 - 19, 21, 22, 30, 51 (TT - PD).

P. pulla Ach. = *Neofuscelia pulla*.

P. saxatilis (L.) Ach. - 1 - 3, 5, 8, 14, 17 - 19, 21, 23, 26, 30, 42, 48 (NT - AIT, ST - PD).

P. stenophylla auct. = *Xanthoparmelia somloënsis*.

P. stygia (L.) Ach. = *Melanelia stygia*.

P. substygia Räsänen = *Melanelia tominii*.

P. sulcata Taylor - 1 - 6, 8, 12, 14, 15, 17 - 19, 26, 30, 48 (NT - AIT, ST - PD).

P. taractica auct. non Kremp. = *Xanthoparmelia somloënsis*.

P. teretiuscula Oksner = *Melanelia stygia* (L.) Essl.

P. tominii Oksner = *Melanelia tominii*.

PARMELIELLA arctophila (Th. Fr.) Malme - 8, 42 (ST - PD).

P. triptophylla (Ach.) Müll. Arg. - 14, 17 (TT, AT); confirm. P. M. Jørgensen, 1992 (BG).

PARMELIOPSIS aleurites (Ach.) Nyl. = *Imshaugia aleurites*.

P. ambigua (Wulfen) Nyl. Syn. *Foraminella ambigua* (Wulfen) S. L. F. Mey. - 1 - 3, 5, 7, 14 (NT, SA, ST - TT).

P. hyperopta (Ach.) Arnold. Syn. *Foraminella hyperopta* (Ach.) S. L. F. Mey. - 1 - 3, 5, 7, 14 (NT, SA, ST - TT).

PELTIGERA aphthosa (L.) Willd. - 1 - 21, 23 - 27, 30, 33, 42, 49 (NT - AIT, FT - PD).

P. canina (L.) Willd. - 3, 7, 8, 12, 14 - 19, 21, 22 - 24, 26, 30, 42, 49 (NT, ST - PD).

P. didactyla (With.) J. R. Laundon. Syn. *P. spuria* (Ach.) DC. - 1 - 3, 5 - 8, 10, 12, 14 - 17, 19, 21, 26, 42 (NT - AIT, FT - PD).

P. elisabethae Gyeln. - 14 (TT); rev. O. Vitikainen, 1993 (H, LE).

P. frippii Holt-Hartw. - 14, 17 (TT - AT); rev. O. Vitikainen, 1993 (H, LE).

P. horizontalis (Huds.) Baumg. - 16 (TT).

P. kristinssonii Vitik. - 14, 19 (TT - AT); rev. O. Vitikainen, 1993 (H, LE).

P. lepidophora (Nyl.) Bitter - 1 - 6, 8, 12, 14, 17, 19 (NT - AIT, FT - AT).

P. leucophlebia (Nyl.) Gyeln. - 1 - 8, 12, 14 - 17, 21, 42 (NT - AIT, FT - PD).

- P. malacea* (Ach.) Funck - 1 - 3, 5, 6, 8, 12, 14, 17, 19, 21, 24, 26 (NT - AIT, FT - AT).
- P. neckeri* Hepp ex Müll. Arg. - 5, 7, 8, 14, 19, 26, 42 (AIT, ST - PD).
- P. polydactylon* (Neck.) Hoffm. - 1, 2, 5, 8, 12, 16, 18, 19 (NT, SA, FT - AT).
- P. rufescens* (Weiss) Humb. - 1 - 8, 12, 14 - 17, 19, 21, 22 (cf.), 25, 26, 49 (NT - AIT, FT - PD).
- P. scabrosa* Th. Fr. - 1, 2, 8, 12, 14 - 19, 21 - 23, 26, 27, 49 (NT, FT - PD).
- P. spuria* (Ach.) DC. = *P. didactyla*.
- P. venosa* (L.) Hoffm. - 1 - 3, 5, 6, 8, 12, 14 - 16, 18, 19, 23, 26, 42 (NT - AIT, FT - PD).
- PERTUSARIA** *amara* (Ach.) Nyl. v. *flotowiana* (Flörke) Vain. - 1 - 3, 5, 6 (mostly on naked drift-wood, NT - AIT).
- P. bryontha* (Ach.) Nyl. - 1, 2, 5, 6, 8, 12, 14, 16, 18, 19, 21, 24, 26, 42, 48 (NT - AIT, FT - PD).
- P. bryophaga* Erichsen - 8, 12 (v. *robustior* Erichsen), 26, 42 (FT - PD).
- P. christae* Dibben & Poelt - 2 (NT); rev. J. Poelt, 1994 (GZU, LE).
- P. corallina* (L.) Arnold - 1, 2, 5, 6 (NT - AIT).
- P. coriacea* (Th. Fr.) Th. Fr. - 1, 2, 8, 10, 12, 16, 18, 21 (cf.), 23, 32 (NT, AIT, FT - AT/PD).
- P. dactylina* (Ach.) Nyl. - 1, 2, 8, 12, 14 - 18, 21, 26, 32 - 34, 35, 42 (NT - AIT, FT - PD).
- P. diffusilis* Erichsen = *P. glomerata*.
- P. excludens* Nyl. - 1 - 6, 21 (NT - AIT, AT).
- P. geminipara* (Th. Fr.) C. Knight - 4 - 6, 8, 14, 16, 17, 26, 42, 46, 51 (NT - AIT, ST - PD).
- P. cf. globulata* Oksner & Volkova - 1 - 6 (NT - AIT).
- P. glomerata* (Ach.) Schaer. Syn. *P. diffusilis* Erichsen - 1 - 3, 5, 8, 12, 16, 18, 21, 24, 26, 32, 42, 46 (NT - AIT, FT - PD).
- P. lactea* (L.) Arnold - 1 - 6 (NT - AIT).
- P. octomela* (Norman) Erichsen - 8, 12, 16, 19, 21 (cf.), 23, 24, 42 (FT - PD).
- P. oculata* (Dicks.) Th. Fr. - 1, 2, 8, 14, 15, 17, 18, 19, 21, 26, 27, 32, 42 (NT, ST - PD).
- P. panyrga* (Ach.) A. Massal. - 1 - 3, 6, 8, 12, 14, 16 - 19, 21, 26 (NT - AIT, FT - AT/PD).
- P. cf. rupestris* (DC.) Schaer. - 3, 4, 21 (NT, SA, AT).
- P. solitaria* H. Magn. - 1 - 5 (also occurs on drift-wood), 17, 21 (NT - AIT, AT).
- P. subdactylina* Nyl. - 1 - 6, 8, 12, 14, 17, 19, 21, 42 (NT - AIT, ST - PD).
- P. subobducens* Nyl. - 8 (ST).
- P. trachydactyla* Vain. - 12 (FT).

P. trochiscea Norman - 8, 48 (ST - PD).

PHAEOCALICIUM compressulum (Nyl. ex Szatala) A. F. W. Schmidt - 5 (NT).

P. praecedens (Nyl.) A. F. W. Schmidt - 14 (TT); det. A. N. Titov, 1992 (LE).

PHAEOPHYSCIA constipata (Norrl. & Nyl.) Moberg - 1 - 3, 5, 8, 12, 16, 19, 26, 42 (?) (NT - AIT, FT - PD).

P. endococcina (Körb.) Moberg - 1, 3, 14, 17 (NT, SA, TT, AT).

P. hispidula (Ach.) Essl. - 1 - 3 (NT, SA); rev. R. Moberg, 1992 (LE).

P. kairamoi (Vain.) Moberg - 8 (?), 14 (rev. R. Moberg, 1993) (ST, TT).

P. nigricans (Flörke) Moberg - 1 - 3, 5, 6, 14, 17 (NT - AIT, TT, AT).

P. sciastra (Ach.) Moberg - 1 - 6, 14, 17 (NT - AIT, TT, AT).

PHAEORRHIZA nimbosea (Fr.) H. Mayrhofer & Poelt - 1 - 3, 8, 12, 19, 21, 24, 32, 42 (NT - AIT, FT - PD).

P. sareptana (Tomin) H. Mayrhofer & Poelt - 2, 3 (NT); confirm. H. Mayrhofer, 1994 (LE).

PHYSCIA aipolia (Ehrh. ex Humb.) Fűrnr. - 1 - 3, 14 [v. *alnophila* (Vain.) Lyng.] (NT, SA, TT).

P. albinea (Ach.) Malbr. - 1, 21 (cf.) (SA, AT/PD); det. R. Moberg, 1993 (UPS).

P. caesia (Hoffm.) Fűrnr. Syn. *P. wainioi* Räsänen - 1 - 6, 8, 14, 17, 18, 21, 32, 42, 48, 49 (NT - AIT, ST - PD).

P. dubia (Hoffm.) Lettau - 1 - 5, 14, 17 - 19, 21, 26, 32, 42, 48 (NT - AIT, TT - PD).

P. phaea (Tuck.) J. W. Thomson - 1 - 3, 48 (NT - AIT, PD).

P. stellaris (L.) Nyl. - 2 (cf.), 42 (NT, SA, PD).

P. tribacia (Ach.) Nyl. = ? *P. dubia*.

P. wainioi Räsänen = *P. caesia*.

PHYSCONIA detersa (Nyl.) Poelt - 14, 17 (TT - AT).

P. muscigena (Ach.) Poelt - 1 - 6, 8, 12, 14, 16, 17, 19, 21, 23, 26, 42, 49 51 (NT - AIT, FT - PD).

P. perisidiosa (Erichsen) Moberg - 1 - 3, 21 (NT - AIT, AT/PD).

PHYTOCONIS viridis (Ach.) Redh. & Kuyper. Syn. *Omphalina hudsoniana* (H. S. Jenn.) H. E. Bigelow

PILOPHORUS cereolus (Ach.) Th. Fr. in Hellb. - 1 - 3, 5, 6 (NT - AIT).

P. dovrensis (Nyl.) Timdal, Hertel & Rambold. Syn. *P. pallidus* (Th. Fr.) Timdal, *Lecidea pallida* Th. Fr. - 4 - 6 (NT, AIT).

P. pallidus (Th. Fr.) Timdal = *P. dovrensis*.

P. robustus Th. Fr. - 6, 21, 32 (AIT, AT/PD).

PLACIDIOPSIS cervinula (Nyl.) Vain. - 8, 12, 19, 26, 42 (FT - PD).

PLACODIUM elegans (Link) Ach. = *Xanthoria elegans*.

Placodium circinatum (Pers.) Gray = *Lobothallia radiosa*.

P. fruticosum Elenkin = *Xanthoria fruticulosa*.

P. murorum (Hoffm.) DC. = *Caloplaca saxicola*.

PLACOPSIS gelida (L.) Linds. - 1 - 3, 5, 6, 14, 42 (NT - AIT, TT - PD).

PLACYNTHIELLA uliginosa (Schrad.) Coppins & P. James - 1 - 5, 8, 32
(NT, SA, ST - AT/PD).

PLACYNTHIUM asperellum (Ach.) Trevis. - 3 (cf.), 36 (NT, PD).

P. nigrum (Huds.) Gray - 2 - 4, 6, 21, 32, 48 (NT - AIT, AT, PD).

POLYBLASTIA bryophila Lönnr. - 2, (cf.), 8, 18, 23, 24, 42 (AIT, ST - PD).

P. gelatinosa (Ach.) Th. Fr. Syn. *P. nigrata* (Nyl.) Lönnr. - 2, 3, 8, 19, 23, 26,
42, 51 (NT, AIT, ST - PD).

P. gothica Th. Fr. - 42 (PD).

P. hyperborea Th. Fr. - 23, 38, 42 (TT - PD).

P. melaspora (Taylor) Zahlbr. Syn. *P. scotinospora* (Nyl.) Hellb. - 24, 42
(AT, PD).

P. nigrata (Nyl.) Lönnr. = *P. gelatinosa*.

P. scotinospora (Nyl.) Hellb. = *P. melaspora*.

P. sendtneri Kremp. - 1 - 3, 8, 51 (NT - AIT, ST - PD).

P. terrestris Th. Fr. - 1, 2, 6, 15, 18, 23, 32, 42, 51 (SA, AIT, TT - PD).

P. theleodes (Sommerf.) Th. Fr. - 23, 36, 42, 51 (TT - PD).

POLYCHIDIUM muscicola (Sw.) Gray - 1 - 3, 5, 6, 12, 21 (NT - AIT, FT
- AT/PD).

PORINA mammillosa (Th. Fr.) Vain. - 1, 3, 6, 14, 21 (NT, SA, TT -
AT/PD).

PORPIDIA ? *albocaerulescens* (Wulfen in Jacq.) Hertel & Knoph - 48 (PD).

P. cinereoatra (Ach.) Hertel & Knoph - 3 (NT).

P. crustulata (Ach.) Hertel & Knoph - 3, 48 (NT, PD).

P. flavocaerulescens auct. = *Porpidia melinodes*.

P. macrocarpa (Dc.) Hertel & A. J. Schwab - 24, 42, 48 (AT, PD).

P. melinodes (Körb.) Gowan & Ahti. Syn. *Huilia flavocaerulescens* auct.,
Porpidia flavocaerulescens auct. - 3, 21 (NT, AT).

P. speirea (Ach.) Kremp. - 36 (PD).

P. superba (Körb.) Hertel & Knoph - 32 (AT/PD).

P. cf. tuberculosa (Sm. in Sm. & Sowerby) Hertel & Knoph - 6 (NT); det. J. Poelt, 1994 (LE).

PROTOBLASTENIA siebenhaariana (Körb.) J. Steiner - 40 (PD).

P. terricola (Anzi) Lyngbe - 1, 21, 26, 42 (NT, AT, PD).

PROTOPARMELIA badia (Hoffm.) Hafellner - 4 - 6, 24 (NT - AIT, AT).

? *P. nephaea* (Sommerf.) R. Sant. Syn. *Lecanora nephaea* Sommerf. - 4, 5 (NT - AIT).

PROTOTHELENELLA leucothelia (Nyl.) H. Mayrhofer & Poelt. Syn. *Microglæna leucothelia* (Anzi) Arnold - 5, 12 (NT, FT - TT).

P. sphinctrinoidella (Nyl.) H. Mayrhofer & Poelt. Syn. *Microglæna reducta* (Th. Fr.) Hellb. - 32, 42 (AT/PD, PD).

P. sphinctrinoides (Nyl.) H. Mayrhofer & Poelt. Syn. *Microglæna sphinctrinoides* (Nyl.) Lönnr. - 5, 32, 34, 35, 42 (NT, AT/PD, PD).

PSEUDEPHEBE minuscula (Nyl. ex Arnold) Brodo & D. Hawksw. - 4, 5, 14, 17 - 19, 21, 24, 32, 36, 38, 42, 44, 48 (NT, AIT, TT - PD).

P. pubescens (L.) M. Choisy - 5, 14, 17 - 19, 21, 30, 32, 34, 35, 42, 46 - 48, 52 (NT, TT - PD).

PSORA decipiens (Hedw.) Hoffm. - 3 - 5, 12, 19, 21 (NT, SA, TT, AT).

P. globifera (Ach.) A. Massal. - 1 - 6 (NT - AIT).

P. lurida (Ach.) DC. = *Lecidea lurida*.

P. rubiformis (Ach.) Hook. - 1 - 6, 17, 21 (NT - AIT, AT).

PSOROMA hypnorum (Vahl) Gray - 1, 2, 6 - 8, 10, 12, 14 - 19, 21, 22, 24 - 27, 30, 42, 48, 49 (NT - AIT, FT - PD).

PSORULA rufonigra (Tuck.) Gotth. Schneid. - 1 - 3, 5 (NT, SA).

RAMALINA almquistii Vain. - 26 (AT).

R. capitata (Ach.) Nyl. - 1, 2, 5 (NT, SA).

RHEXOPHIALE coronata Th. Fr. = *Sagiolechia rhexoblephara*.

RHIZOCARPON alpicola (Anzi) Rabenh. - 36 (PD).

R. amphibium (Fr.) Th. Fr. - 32 (AT/PD).

R. disporum (Nägeli ex Hepp) Müll. Arg. - 3, 49 (NT, PD).

R. badioatrum (Flörke ex Spreng.) Th. Fr. - 48 (PD).

R. copelandii (Körb.) Th. Fr. - 24, 36 (AT, PD).

R. disporum (Nägeli ex Hepp) Müll. Arg. - 48 (PD).

- R. eupetraeoides* (Nyl.) Blomb. & Forssell - 24, 32 (AT, AT/PD).
R. eupetraeum (Nyl.) Arnold - 32, 42 (AT/PD, PD).
R. expallescens Th. Fr. - 32 (AT/PD).
R. frigidum Räsänen - 48 (PD).
R. geminatum Körb. - 3, 4 (NT - AIT).
R. geographicum (L.) DC. - 3, 24, 32, 36, 38, 41 - 44, 47 - 49 (NT, AT - PD).
R. grande (Flörke ex Flot.) Arnold - 2, 3, 24, 36 (cf.), 39 (cf.) (NT, AT, PD).
R. hochstetteri (Körb.) Vain. - 24, 32 (AT, AT/PD).
R. jemtlandicum (Malme) Malme - 24, 36, 48 (AT, PD).
R. macrosporum Räsänen - 48 (PD).
R. obscuratum (Ach.) A. Massal. Syn. *R. orphninum* (Vain.) Zahlbr. - 3, 36 (SA, PD).
R. orphninum (Vain.) Zahlbr. = *R. obscuratum*.
R. polycarpum (Hepp) Th. Fr. - 32, 36 (AT, PD).
R. rittokense (Hellb.) Th. Fr. - 24 (AT).
R. saanaëense Räsänen - 48 (PD).
R. simillimum (Anzi) Lettau - 48 (PD).
R. viridiatrum (Wulfen) Körb. - 48 (PD).

RHIZOPLACA chrysoleuca (Sm.) Zopf - 1 - 5, 14, 17 (NT - AIT, TT, AT).
R. melanophthalma (DC.) Leuckert & Poelt - 1 - 3, 5, 6, 48, 52 (AIT, PD).
 ? *R. peltata* (Ramond) Leuckert & Poelt - 4, 5, 52 (NT, SA, PD).

- RINODINA archaea** (Ach.) Arnold - 1 - 3 (NT, SA).
R. archaeoides H. Magn. = *R. olivaceobrunnea*.
R. cf. arctica H. Magn. - 1 (NT).
R. bischoffii (Hepp) A. Massal. - 23 (TT).
R. cacuminum (Th. Fr.) Malme - 18, 24, 48 (AT, PD).
R. cinnamomea (Th. Fr.) Räsänen = *R. mniaraea* v. *cinnamomea*.
R. confragosa (Ach.) Körb. - 2 (NT).
R. exigua (Ach.) Gray - 23 (TT).
R. lecideoides (Nyl.) Kernst. - 5 (NT, AIT).
R. mniaraea (Ach.) Körb. excl. v. *cinnamomea* Th. Fr. - 1 - 3, 5, 6, 8, 12 (incl. v. *mniaraeiza*), 14, 18, 19, 23, 24, 26, 30, 32, 51 (NT - AIT, FT - PD).
R. mniaraea v. *cinnamomea* Th. Fr. Syn. *R. cinnamomea* (Th. Fr.) Räsänen - 8, 14, 16, 19, 42 (ST - PD).
R. olivaceobrunnea C.W.Dodge & G.E.Baker. Syn. *R. archaeoides* H. Magn., *R. soredicola* Degel. - 1 - 5, 8, 12, 15, 16, 22, 26, 42, 51 (NT - AIT, FT - PD).
R. parasitica H. Mayrhofer & Poelt - 2 (NT); det. H. Mayrhofer, 1994 (Zhurbenko 84119, GZU).
R. parvula H. Mayrhofer & Poelt - 2 (NT).

R. roscida (Sommerf.) Arnold - 1 - 3, 5, 6, 8, 12, 16, 19, 23, 26, 42, 48 (NT - AIT, FT - PD).

R. septentrionalis Malme - 3, 14 (cf.) (NT, TT).

R. sophodes (Ach.) A. Massal. - 2 (cf.), 24, 32 (NT, AT, AT/PD).

R. soresdicola Degel. = *R. olivaceobrunnea*.

R. subobscura H. Magn. - 2, 3, 5, 14 (cf.) (NT - AIT, TT).

R. teichophila (Nyl.) Arnold - 3, 40 (SA, PD).

R. turfacea (Wahlenb.) Körb. - 1 - 6, 8, 12, 15, 16, 18, 19, 21 - 26, 29, 30, 32, 42, 46, 48, 49 (NT - AIT, FT - PD).

ROPALOSPORA *lugubris* (Sommerf.) Poelt - 18 (AT).

SAGIOLECHIA *rhexoblephara* (Nyl.) Zahlbr. Syn. *Rhexophiale coronata* Th. Fr. - 32, 34, 35 (AT/PD).

SARCOGYNE *privigna* (Ach.) A. Massal. - 48 (PD).

S. regularis Körb. Syn. *Biatorella pruinosa* (Sm.) Mudd - 43 (PD).

SCHADONIA *fecunda* (Th. Fr.) Vězda & Poelt. Syn. *Lopadium fecundum* Th. Fr. - 16, 18, 26 (TT, AT).

SCHAERERIA *cinereorufa* (Schaer.) Th. Fr. - 1 - 3, 5 (NT, SA).

S. fuscocinerea (Nyl.) Clauzade & Cl. Roux. Syn. *S. tenebrosa* (Flot.) Hertel & Poelt - 48 (PD).

S. tenebrosa (Flot.) Hertel & Poelt = *S. fuscocinerea*.

SCOLICIOSPORUM *umbrinum* (Ach.) Arnold - 1, 3, 14 (NT, TT).

SIPHULA *ceratites* (Wahlenb.) Fr. - 15, 32 (v. *major* Elenkin), 33 - 35, 42 (TT - PD).

S. delicata Elenkin = *Pertusaria dactylina*, rev. R. Santesson, 1972 (type in LE).

SOLOLORINA *bispora* Nyl. - 1 - 3, 5, 8, 12, 16, 21, 26, 42, 51 (NT - AIT, FT - PD).

S. crocea (L.) Ach. - 8, 12, 14, 15, 17 - 19, 21, 22, 26, 30, 32, 34, 35, 42, 46, 48, 53 (FT - PD).

S. octospora (Arnold) Arnold - 1, 2, 8, 16, 26, 42 (NT - AIT, ST - PD).

S. saccata (L.) Ach. - 1 - 3, 6, 7, 10, 12, 16, 21, 23, 26, 49 (NT - AIT, FT - PD).

S. spongiosa (Ach.) Anzi - 1, 2, 7, 12, 16, 21, 23 (NT - AIT, ST - AT).

SPHAEROPHORUS *fragilis* (L.) Pers. - 6, 14, 16 - 18, 21, 28, 30, 32, 42, 48 (AIT, TT - PD).

S. globosus (Huds.) Vain. - 1, 2, 4, 6 - 8, 10, 12, 14 - 19, 21, 22, 25 - 27, 29, 30, 32 - 35, 42, 46, 48, 51 (SA, AIT, FT - PD).

SPORASTATIA testudinea (Ach.) A. Massal. Syn. *Biatorella coracina* (Sommerf.) Lynge - 18, 21, 36, 38, 39, 41, 42, 44, 47, 48 (AT, PD).

S. polyspora (Nyl.) Grumann - 17 (AT).

STAUROTHELE fissa (Taylor) Zwackh - 1 (NT).

STEINIA geophana (Nyl.) Stein. Syn. *Biatorella geophana* (Nyl.) Vain. - 12 (TT).

STEREOCAULON alpinum Laurer - 1 - 8, 10, 12, 14 - 19, 21 - 27, 42, 48 (NT - AIT, FT - PD).

S. apocalypticum Nyl. - 1 - 3, 5, 6, 33 (NT - AIT, AT/PD).

S. arcticum Lynge - 8, 12, 51 (cf.) (FT - PD).

S. arenarium (Savicz) I. M. Lamb - 15, 49, 51 (cf.) (TT - PD).

S. botryosum Ach. - 1, 2, 5 - 7, 14, 17 - 19, 21, 42 (NT - AIT, ST - PD).

S. capitellatum H. Magn. - 14, 17 (TT, AT).

S. condensatum Hoffm. - 1, 2, 5, 16 (NT, TT).

S. denudatum Flörke = *S. vesuvianum*

S. depressum (Frey) I. M. Lamb - 1 (SA).

S. glareosum (Savicz) H. Magn. - 1, 2, 4, 7, 8, 12, 14, 17, 19 (NT - AIT, FT - AT).

S. grande (H. Magn.) H. Magn. - 1, 4, 6, 8, 12 (NT, AIT, FT - TT).

S. groenlandicum (E. Dahl) I. M. Lamb - 1 - 6, 14, 17, 18 (NT - AIT, TT, AT).

S. incrustatum Flörke - 12 (TT).

S. paschale (L.) Hoffm. - 1 - 7, 12, 13, 16 (NT - AIT, FT - TT).

S. rivulorum H. Magn. - 1 - 8, 12, 14, 15, 17 - 19, 21, 22, 26, 30, 42, 46, 48, 49, 51 - 53 (NT - AIT, FT - PD).

S. sibiricum I. M. Lamb - 1 - 5 (NT - AIT).

S. spathuliferum Vain. f. *dissolutum* (H. Magn.) Lamb - 1, 2 (NT, SA); rev. A. V. Dombrovskaya, 1988.

S. subcoralloides (Nyl.) Nyl. - 1 - 6, 14, 17 (NT - AIT, TT, AT).

S. symphycheilum I. M. Lamb - 4 (SA).

S. tomentosum Fr. - 1, 2, 23, 42 (NT, TT - PD).

S. vesuvianum Pers. Syn. *S. denudatum* Flörke - 17, 18, 27, 30 (cf.), 32, 33, 42 (AT, PD).

STICTA arctica Degel. - 8, 14, 15, 17 - 19, 21, 26, 42 (ST - PD).

TELOSCHISTES contortuplicatus (Ach.) Clauzade & Rond. - 21 (AT); (GZU, LE, UPS).

TEPHROMELA aglaea (Sommerf.) Hertel & Rambold - 3 (SA).

T. atra (Huds.) Hafellner - 3 - 6 (NT - AIT).

T. testaceoatra (Vain.) Hertel & Rambold, Syn. *Lecidea arctogena* (Th. Fr.) H. Olivier - 2 (cf.), 36 (SA/AIT, PD).

THAMNOLIA vermicularis (Sw.) Schaer. s. lat. - 1 - 8, 10, 12 - 22, 24 - 27, 30, 32, 34, 35, 37, 42, 46, 48, 49, 51 (NT - AIT, FT - PD).

T. vermicularis v. *subuliformis* (Ehrh.) Schaer. - 7, 8, 12, 14, 15, 17, 19, 21, 22, 26, 30, 42, 46, 48, 49 (FT - PD).

THELIDIUM papulare (Fr.) Arnold - 23 (TT).

T. sordidum Th. Fr. - 23 (TT).

THELOCARPON epibolum Nyl. - 21 (AT); (GZU, LE, UPS).

T. cf. tichomirovii Oksner - 2 (SA).

THELOMMA ocellatum (Körb.) Tibell - 2 (SA); det. J. Poelt, 1994 (LE).

THELOPSIS melathelia Nyl. - 1, 21 (SA, AT).

THROMBIUM epigaeum (Pers.) Wallr. - 1, 2, 8, 51 (NT - AIT, ST - PD).

TONINIA aromatica (Sm.) A. Massal. - 18 (AT).

T. cumulata (Sommerf.) Th. Fr. - 18, 23, 24 (TT, AT).

T. groenlandica Lyng = *Arthonia glebosa*

T. lobulata (Sommerf.) Lyng = *Mycobilimbia lobulata*.

T. rosulata (Anzi) H. Olivier - 3 (SA); det. E. Timdal, 1991 (LE).

T. sedifolia (Scop.) Timdal - 1 - 4 (NT, SA).

T. squalida (Ach.) A. Massal. - 1 - 3, 5, 17 (NT - AIT, AT).

T. subaromatica Vain. - 8 (?), 26, 42 (?) (ST - PD).

T. tristis (Th. Fr.) Th. Fr. ssp. *asiae-centralis* (H. Magn.) Timdal - 2 (NT, SA); rev. E. Timdal, 1991 (LE).

TRAPELIOPSIS cf. *gelatinosa* (Flörke) Coppins & P. James - 1 (SA).

T. granulosa (Hoffm.) Lumbsch - 1 - 5 (NT, SA).

TREMOLECIA atrata (Ach.) Hertel - 3, 36, 42, 47, 48 (NT, PD).

TUCKERMANNOPSIS ciliaris (Ach.) Gyeln. Syn. *Cetraria ciliaris* Ach. - 3, 16 (NT, TT).

T. pinastri (Scop.) Hale = *Vulpicida pinastri*.

T. sepincola (Ehrh.) Hale. Syn. *Cetraria sepincola* (Ehrh.) Ach. - 1, 3, 5, 7, 14 (NT, SA, ST, TT).

UMBILICARIA arctica (Ach.) Nyl. - 3 (cf.), 14, 17, 18 (rev. G. B. Feige; ESS, LE), 24, 30, 34, 35, 36 (SA, TT - PD).

U. cylindrica (L.) Delise ex Duby - 14, 17, 18, 21, 30, 32, 36, 42, 48, 52 (TT - PD).

U. decussata (Vill.) Zahlbr. - 1, 6, 14, 17, 18, 21, 42, 47, 48, 52 (AIT, TT - PD).

U. deusta (L.) Baumg. - 1 - 4, 7, 14 (NT - AIT, ST, TT).

U. hirsuta (Sw. ex Westr.) Hoffm. - 1, 4 (NT, SA).

U. hyperborea (Ach.) Hoffm. - 1, 2, 4, 5, 14, 15, 17, 18, 21, 24, 30, 32, 34 - 36, 42, 48 (NT - AIT, TT - PD).

U. lyngei Schol. - 14, 17 (TT, AT); rev. G. B. Feige (ESS, LE).

U. polyphylla (L.) Baumg. - 48 (PD).

U. proboscidea (L.) Schrad. - 1 - 7, 14, 17 - 19, 21, 24, 30, 32, 34 - 36, 38, 52 (NT - AIT, TT - PD).

U. torrefacta (Lightf.) Schrad. - 1 - 7, 14, 18, 21, 30, 32, 34 - 36, 38, 42, 48 (NT - AIT, TT - PD).

U. vellea (L.) Ach. - 17 (AT).

U. virginis Schaer. - 48 (PD).

USNEA sp. - 14, 15 (TT).

VARICELLARIA rhodocarpa (Körb.) Th. Fr. - 8, 12, 14, 26, 42 (FT - PD).

VERRUCARIA aethiobola Wahlenb. - 1, 24, 32, 36, 41, 42 (AIT, AT, PD).

V. cataleptoides (Nyl.) Nyl. - 5 (cf.) (AIT).

V. deversa Vain. - 23 (TT).

V. margacea (Wahlenb.) Wahlenb. - 3 (SA).

V. cf. riparia Nyl. - 2 (NT).

VULPICIDA juniperinus (L.) Mattson & M. J. Lai. Syn. *Cetraria juniperina* (L.) Ach. - 3, 5 (NT, SA).

V. pinastri (Scop.) Mattsson & M. J. Lai. Syn. *Cetraria pinastri* (Scop.) Gray, *Tuckermanopsis pinastri* (Scop.) Hale - 1 - 3, 5, 7, 14, 15 (NT, SA, ST, TT).

V. tilesii (Ach.) Mattson & M. J. Lai. Syn. *Cetraria tilesii* Ach. - 1 - 6, 16, 17, 21, 42, 48, 49 (NT - AIT, TT - PD).

XANTHOPARMELIA conspersa (Ehrh. ex Ach.) Hale - 2, 18 (NT, AT).

X. somloënsis (Gyeln.) Hale. Syn. *Parmelia stenophylla* auct., *P. taractica* auct., non Kremp. - 1 - 6 (NT - AIT).

X. taractica (Kremp.) Hale = *X. somloënsis* (for the Putorana's records from 1 - 6).

- XANTHORIA borealis* R. Sant. & Poelt - 21 (AT), (GZU, LE, UPS).
X. candelaria (L.) Th. Fr. Syn. *X. polycarpa* (Ehrh.) Vain. v. *substellaris* (Ach.) Elenkin - 14, 17 - 19, 21, 23, 26, 30 - 32, 42, 52 (TT - PD).
X. elegans (Link) Th. Fr. Syn. *Placodium elegans* (Link) Ach. - 1 - 6, 14, 17, 18, 19, 21, 23, 29, 36, 38, 40, 42, 48, 49 (NT - AIT, TT - PD).
 ? *X. fallax* (Hepp) Arnold - 1, 2 (NT, SA).
X. polycarpa (Ehrh.) Vain. v. *substellaris* (Ach.) Elenkin = *X. candelaria*.
X. sorediata (Vain.) Poelt - 1 - 3, 5, 14, 48, 49 (NT - AIT, TT - PD).
X. subfruticulosa (Elenkin) Piin. Syn. *Placodium fruticosum* Elenkin - 1 - 3, 5, 42 (NT - AT, PD).

XYLOGRAPHA abietina (Pers.) Zahlbr. = *X. parallela*.
X. parallela (Ach.: Fr.) Behlen & Desberg. Syn. *X. abietina* (Pers.) Zahlbr. - 1 - 3, 5, 14, 23 (NT, SA, TT).
X. cf. trunciseda (Th. Fr.) Minks in Redinger - 14 (TT).
X. vitiligo (Ach.) J. R. Laundon - 5 (NT); det. J. Poelt, 1994 (LE).

II. LICHENICOLOUS FUNGI

- ARTHONIA clemens* (Tul.) Th. Fr. - 21 (AT), on *Pannaria pezizoides* (ap.).
A. epiphyscia Nyl. - 21 (AT), on *Physcia caesia* (th.).
A. excentrica Th. Fr. - 21 (AT), on *Lepraria* spp. (th.).
A. fuscopurpurea (Tul.) R. Sant. - 1 (SA), on *Solorina* sp. (th.).
A. linitae R. Sant. - 21 (AT), on *Lobaria linita* (th.).
A. molendoi (Heufl. ex Frauenf.) R. Sant. - 2 (NT), on *Xanthoria* spp. (th.).
A. peltigerea Th. Fr. - 21 (AT), on *Solorina saccata* (ap., th.).
A. peltigerina (Almq.) H. Olivier - 21 (AT), on *Peltigera aphthosa* (th.), *P. cf. malacea* (th.), *P. rufescens* (th.), *P. sp.* (th.).
A. stereocaulina (Ohlert) R. Sant. - 2 (NT), on *Stereo-caulon alpinum* (th.).

BISPORA christiansenii D. Hawksw. - 5 (NT) on *Lecanora* sp. (ap.).

CARBONEA vitellinaria (Nyl.) Hertel - 1, 2, 21 (NT - AIT, AT), on *Candelariella cf. placodizans* (th.), *C. vitellina* (ap., th.).

CERCIDOSPORA epipolytropa (Mudd) Arnold - 4 (NT/SA), on *Lecanora polytropa* (ap., th.).
C. cf. lichenicola (Zopf) Hafellner - 51 (PD), on *Pannaria pezizoides* (th.).
C. stereocaulorum (Arnold) Hafellner - 21 (AT), on *Stereocaulon cf. rivulorum* (th.), *S. spp.* (th.).
C. ulothii Körb. - 21 (AT), on *Lecanora geophila* (th.).

CORTICIFRAGA peltigerae (Nyl.) D. Hawksw. & R. Sant. - 21 (AT), on *Peltigera* cf. *canina*, *P. cf. rufescens* (th.).

DACAMPIA hookeri (Borrer) A. Massal. - 8, 21, 26, 32, 42 (ST - PD), on sterile terricolous lichen (th.).

DACTYLOSPORA deminuta (Th.Fr.) Triebel - 1, 2, 14, 15, 21 (NT, TT, AT), on *Lecanora epibryon* (ap., th.), *Lopadium coralloideum* (th.), *Pannaria pezizoides* (th.), *Rinodina turfacea* (ap., th.), sterile crustaceous terricolous lichen (th.).

D. glaucomarioides (Willey ex Tuck.) Hafellner - 21 (AT), on *Ochrolechia* cf. *frigida* (th.), *O. upsaliensis* (th.).

D. parasitica (Flörke) Zopf - 21 (AT), on *Megaspora verrucosa* (ap., th.), *Pertusaria rupestris* (th.).

D. pertusariicola (Willey ex Tuck.) Hafellner - 21 (AT), on *Pertusaria solitaria* (ap., th.).

D. purpurascens Triebel - 5 (NT), on *Amygdalaria pelobotryon* (ap., th.).

D. saxatilis (Schaer.) Hafellner - 21 (AT), on *Pertusaria* cf. *excludens* (th.).

DIDYMELLOPSIS cf. **collematum** (J. Steiner) Grube & Hafellner - 21 (AT), on *Collema polycarpon* (th.).

ECHINOTHECIUM reticulatum Zopf - 21 (AT), on *Parmelia omphalodes* (th.).

ENDOCOCCUS gyrophorarum (Arnold) J. C. David & D. Hawksw. - 21 (AT), on *Umbilicaria decussata* (th.).

E. perpusillus Nyl. - 21 (AT), on *Mycobilimbia lobulata* (th.), *Rhizocarpon* sp. (th.).

E. propinquus (Körb.) D. Hawksw. - 4, 5, 21 (NT, AT), on *Aspicilia* sp. (th.), *Porpidia melinodes* (th.), *P. sp.* (th.).

E. rugulosus Nyl. agg - 1, 5, 6, 21 (NT - AIT, AT), on *Amygdalaria pelobotryon* (th.), *Aspicilia* spp. (th.), *Dermatocarpon* sp. (th.), *Rhizocarpon* sp. (th.), saxicolous crustaceous lichen (th.).

GELTINGIA associata (Th. Fr.) Alstrup & D. Hawksw. - 14, 15, 21, 30 (TT, AT), on *Ochrolechia* cf. *androgyna* (th.), *O. frigida* (th.), *O. sp.* (th.), *Thamnolia vermicularis* v. *subuliformis* (!) (th.).

ILLOSPORIUM carneum Fr. - 21 (AT), on *Peltigera rufescens* (th.).

LASIOSPHAERIOPSIS stereocaulicola (Linds.) O. E. Erikss. & R. Sant. - 21 (AT), on *Stereocaulon botryosum* (th.).

LICHENOCONIUM lecanorae (Jaap) D. Hawksw. - 21 (AT), on *Biatora* sp. (ap.), *Lecanora sulphurea* (ap., th.).

LLIMONIELLA neglecta (Vain.) Triebel & Rambold - 3, 21 (SA, AT), on *Lepraria* spp. (th.).

MERISMATIUM coccisporum (Norman) Vouaux - 21 (AT), on *Lepraria* sp. (th.).

M. decolorans (Rehm ex Arnold) Triebel - 2 (NT), on *Cladonia pyxidata* (th. - podetia).

M. heterophractum (Nyl.) Vouaux - 3 (NT), on *Cladonia* sp. (th.).

MUELLERELLA hospitans Stizenb. - 21 (AT), on crustaceous, terricolous lichen (th.).

M. lichenicola (Sommerf.:Fr.) D. Hawksw. - 1, 3, 21 (NT, AT), on *Caloplaca* sp. (ap.), *Lecidella* sp. (th.), *Ochrolechia* sp. (th.), *Toninia squalida* (th.), *Xanthoria borealis* (th.), *X. elegans* (ap., th.).

M. pygmaea (Körb.) D. Hawksw. - 5, 21 (NT - AIT, AT), on *Buellia* sp. (th.), *Caloplaca* sp. (ap., th.), *Lecanora dispersa* (ap.), *L. hagenii* (ap.), *L. polytropa* (th.), *L.* sp. (ap., th.), *Lecidea* spp. (th.), *Pertusaria* sp. (th.), *Xanthoria elegans* (ap., th.), squamulose terricolous and crustaceous saxicolous lichens (th.).

NESOLECHIA oxyspora (Tul.) A. Massal. = *Phacopsis oxyspora*.

PEZIZELLA epithallina (W. Phillips & Plowr.) Sacc. - 21 (AT), on *Peltigera didactyla* (th.).

PHACOPSIS oxyspora (Tul.) Triebel & Rambold. Syn. *Nesolechia oxyspora* (Tul.) A. Massal. - 2, 3, 5 (NT, SA), on *Melanelia infumata* (th.), *Parmelia omphalodes* (th.), *P. saxatilis* (th.), *P. sulcata* (th.).

PHAEOSPORA peltigericola D. Hawksw. - 3 (NT), on *Peltigera* sp. (th.).

PHAEOSPOROBOLUS alpinus R. Sant., Alstrup & D. Hawksw. - 3, 14, 21 (NT, TT, AT), on *Caloplaca ammiospila* (th.), *Ochrolechia frigida* (th., ap.), *O. cf. upsaliensis* (th.), *O.* sp. (th.).

P. usneae D. Hawksw. & Hafellner - 21 (AT), on *Evernia perfragilis* (th.).

PLEOSPORA engeliana (Saut.) G. Winter - 6, 21, 51 (AIT, AT, PD), on *Solorina bispora* (th.), *S. saccata* (th.), *S. spongiosa* (th.).

POLYCOCCUM bryonthae (Arnold) Vězda - 2 (NT), on *Lecanora epibryon* (ap.).

- P. trypethelioides* (Th. Fr.) R. Sant. - 1, 21 (NT, AT), on *Stereocaulon* spp. (th.).
- PRONECTRIA solorinae* Lowen & R. Sant. - 51 (PD), on *Solorina spongiosa* (ap.).
- SCUTULA stereocaulorum* (Anzi) Körb. - 1, 5, 21, 30, 48 (NT - AIT, AT, PD), on *Stereocaulon alpinum* (th.), *S. rivulorum* (th.), *S. sp.* (th.).
- SPHAERELLOTHECIUM araneosum* (Rehm ex Arnold) Zopf - 1, 14, 21 (SA, TT, AT), on *Arctoparmelia separata* (th.), *A. sp.* (th.), *Ochrolechia* cf. *androgyna* (th.), *O. frigida* (th.), *O. upsaliensis* (th., ap.), *O. sp.* (th.), *Pertusaria* sp. (th.).
- STIGMIDIUM cerinae* Roux & Triebel - 21 (AT), on *Caloplaca cerina* (ap.).
- S. conspurcans* (Th. Fr.) Triebel & R. Sant. - 1, 21 (NT, AIT, AT), on *Psora rubiformis* (th.).
- S. frigidum* (Sacc.) Alstrup & D. Hawksw. - 21, 51 (AT, PD), on *Thamnolia vermicularis* vars. *subuliformis*, *vermicularis* (th.).
- S. peltideae* (Vain.) R. Sant. - 21 (AT), on *Peltigera aphthosa*, *P. cf. rufescens* (th.).
- S. cf. pseudopeltideae* Roux & Triebel - 21 (AT), on *Peltigera* sp. (th.).
- S. schaereri* (A. Massal.) Trevis. s. str. - 21 (AT), on *Dacampia hookeri* (th.).
- S. solorinae* (Vain.) D. Hawksw. - 21 (AT), on *Solorina spongiosa* (th.).
- TRIMMATOSTROMA lichenicola* M. S. Christ. & D. Hawksw. - 21 (AT), on *Caloplaca* sp. (ap.).
- WENTIOMYCES peltigericola* D. Hawksw. - 21 (AT), on *Peltigera aphthosa* (th.).
- ZWACKHIOMYCES berengerianus* (Arnold) Grube & Triebel agg. - 5, 21 (AIT, AT), on *Biatora carnealbida* (th.), *B. sp.* (th.), *Mycobilimbia berengeriana* (th.).
- Z. dispersus* (J. Lahm ex Körb.) Triebel & Grube - 21 (AT), on *Protoblastenia terricola* (th.).

ACKNOWLEDGEMENTS

I am deeply indebted to the following colleagues for assisting with revisions of my material: Prof. Teuvo Ahti, Helsinki; Dr. Othmar Breuss, Vienna; Dr. Irwin M. Brodo, Ottawa; Dr. Anna V. Dombrovskaya, Kirovsk-St.-Petersburg; Prof. G. Benno Feige, Essen; Dr. Josef Hafellner, Graz; Dr. Eric

Steen Hansen, Copenhagen; Prof. Per Magnus Jørgensen, Bergen; Dr. Ingvar Kärnefelt, Lund; Prof. Hildur Krog, Oslo; Dr. Helmut Mayrhofer, Graz; Dr. Roland Moberg, Uppsala; Dr. Anders Nordin, Uppsala; Dr. Taimi Piin, Tallinn; Prof. Josef Poelt, Graz; Prof. Rolf Santesson, Uppsala; Dr. Ulrik Søchting, Copenhagen; Dr. Einar Timdal, Oslo; Dr. Alexandr N. Titov, St. Petersburg; Dr. Orvo Vitikainen, Helsinki.

I wish to thank Prof. Boris N. Norin, Dr. Nadezhda V. Matveeva and Dr. Dmitriy Bol'shiyanov for supporting my field studies at the Putorana Plateau and Taymyr Peninsula. They and Prof. Nina S. Golubkova, Dr. Irina I. Makarova, Dr. Evgeniya A. Khodachek and Dr. Marina S. Boch are thanked for their help with the literature compilation and/or stimulating discussions. Prof. Teuvo Ahti; Prof. Josef Poelt, Prof. Rolf Santesson and Dr. Leif Tibell are thanked for many valuable comments and improvements to this manuscript. Mr. Peer Corfixen and Dr. Ovidiu Constantinescu are thanked for computer assistance. I wish to express my gratitude to Dr. Nancy Auerbach and Mr. Paul Boike who revised the English.

The work was promoted by grants from the Karl-Franzens-University in Graz; the University of Copenhagen and the Swedish Institute (Uppsala University), which supported my studies in their herbaria and libraries. For this opportunity, I am much obliged to Prof. Josef Poelt, Dr. Ulrik Søchting; Dr. Eric Steen Hansen; Dr. Roland Moberg and Prof. Rolf Santesson.

REFERENCES

- Ahti, T. (1993) Names in current use in the *Cladoniaceae* (lichen-forming Ascomycetes) in the ranks of genus to variety. *Regnum Veg.* **128**: 58-106.
- Ahti, T. & Zhurbenko, M. P. (1994) Distribution of *Cladonia alaskana* in Asia. *Graphis Scripta* **6**: 11-14.
- Alexandrova, V. D. (1937) The tundra in the right shore of Popigay River. *Trudy Arktich. Inst., Leningrad* **63**: 181-206.
- Alexandrova, V. D. (1983) *Rastitel'nost' polyarnykh pustyn' SSSR*. Leningrad: Nauka.
- Almqvist, E. (1882) Lichenologiska iakttagelser på Sibiriens nordkust. In *Vega-expeditionens Vetenskapliga Iakttagelser* Part 1: 195-222. Stockholm.
- Andreev, M. P. (1983) De lichenibus e Terra Boreali notula. *Novosti Sist. Nizsh. Rast.* **20**: 139-141.
- Andreev, M. P., Afonina O. M. & Potemkin, A. D. (1993) Bryophytes and lichens of the Komsomolets and Bolshevik Island (the Severnaya Zemlya Archipelago). *Bot. Zhurn. (Moscow & Leningrad)* **78**(2): 69-79.
- Anonymous (1975) Legenda k srednemasshtabnoy geobotanicheskoy karte Taymyra. *Trudy Nauchno-Issl. Inst. Sel'skogo Khozyaystva Kraynego Severa, SO VASKhNIL* **21**: 39-49.

- Avramtchik, M. N. (1937) Geobotanical and range characteristics of the district of Dudypa River. *Trudy Arktich. Inst., Leningrad* **63**: 47-81.
- Bridson, D. R. & E. R. Smith, eds. (1991) *Botanico-Periodicum-Huntianum/Supplementum*. Pittsburg: Hunt Inst. Bot. Docum.
- Brummitt, R. K. & C. E. Powell, eds. (1992) *Authors of Plant Names*. Kew: Royal Bot. Gards.
- Chernov, Yu. I. & Matveeva, N. V. (1979) Zakonomernosti zonal'nogo raspredeleniya soobshchestv na Taymyre. In *Arctic tundras and polar deserts of Taimyr* (V. D. Alexandrova & N. V. Matveeva, eds.): 166-200. Leningrad: Nauka.
- Elenkin, A. A. (1906) Species novae lichenum in Sibiria arctica a cl. A. A. Birula-Bialynizki collectae (expeditio baronis Toll). *Annales Mycologici* **4**(1): 36-38.
- Elenkin, A. A. (1909) Les Lichens des cotes polaires de la Siberie. *Zap. Imp. Akad. Nauk Fiz.-Mat. Otd.* **26**(1): 1-53.
- Fes'ko, N. N. (1991) Lishayniki. In Egorova, A. A., Vasil'eva, I. I., Stepanova, N. A., Fes'ko, N. N. *Flora tundrovoy zony Yakutii*: 88-115. Yakutsk: YaNTs SO AN SSSR.
- Hafellner, J., Zhurbenko, M. P. (1994) Lichenicolous fungi from the Putorana Plateau, Central Siberian Subarctic. Unpublished manuscript. Graz - St.-Petersburg.
- Holmgren, P. K., Holmgren, N. H. & L. C. Barnett, eds. (1990) Index Herbariorum. 8th Edn. *Regnum Veg.* **120**.
- Isakov, I. S., ed. (1952) *Morskoy Atlas*. Vol. 1. Morskoy General'nyi Shtab.
- Khodachek, E. A. (1986) The main plant communities in the western part of the October Revolution Island (Severnaya Zemlya). *Bot. Zhurn. (Moscow & Leningrad)* **71**: 1628-1638.
- Khodachek, E. A. & Makarova, I. I. Lichens from the northwestern coast of Taimyr (Sterlegova Cape). *Bot. Zhurn. (Moscow & Leningrad)* (in prep.).
- Korotkevich, E. S. (1958) The vegetation of Severnaya Zemlya. *Bot. Zhurn. (Moscow & Leningrad)* **43**: 644-663.
- Kotlov, Yu. V. (1993a) Lichens of bird colonies in west Siberian Arctic. In *Global Change and Arctic Terrestrial Ecosystems, Intern. Conference(21-26 Aug. 1993), abstracts*: 122. Oppdal: NINA.
- Kotlov, Yu. V. (1993b) The lichens collected on the bird's colony in the north-western part of Bolshevik island (Severnaya Zemlya). *Bot. Zhurn. (Moscow & Leningrad)* **78**(8): 34-36.
- Kotlov, Yu. V. (1993c) Underwater lichens from Predgornoe lake (Bolshevik island, Severnaya Zemlya) In *Global Change and Arctic Terrestrial Ecosystems, Intern. Conference(21-26 Aug. 1993), abstracts*: 123. Oppdal: NINA.
- Kozhevnikov Yu. P., Zhurbenko, M. P. & Afonina, O. M. (1994) The vegetation of the small islands in the Kara Sea (Sverdrupa and Troynoy Is.). Unpublished manuscript. St.-Petersburg: Komarov Botanical Institute.

- Kuvajev, W. B. (1980) *Vysotnoe raspredelenie rasteniy v gorakh Putorana*. Leningrad: Nauka.
- Kuvajev, W. B., Ryabchikova, A. I. & Gruznyakova, N. B. (1974) Vazhneyshie kormovye lishayniki gor Putorana i ikh vysotnoe raspredelenie. In *Biologicheskie problemy Severa, VI Symposium, abstracts*. Part 4: 32-34. Yakutsk: Yakutskii filial SO AN SSSR.
- Kuvajev, W. B., Kozhevnikova, A. D., Gudoshnikov, S. V., Zhurbenko, M. P. & Nezdoimnogo, E. L. (1994) *The plant cover of Sibiriyakov Island*. Moscow.
- Kuznetsov, N. I. (1916) Rastitel'nost' Eniseyskoy lesotundry. In *Predvaritel'nyy otchet o botanicheskikh issledovaniyakh v Sibiri i Turkestanе v 1914 g.* (B. A. Fedchenko, ed.): 1-29. Petrograd.
- Kuznetsov, N. I. (1932) "Laidy" v nizov'yakh r. Eniseya, ikh stroenie, obrazovanie i mesto v klassifikatsionnoy skheme bolotno-lesnykh obrazovaniy. *Trudy Polyarn. Komiss.* **12**: 1-40.
- Lyngbe, B. (1929) Vascular plants and lichens. In *The Norwegian North Polar Expedition with the "Maud" 1918-1925, Scientific results* (H. U. Sverdrup, ed.) Vol. V, No. 1: 1-15. Bergen.
- Malme, G. O. (1932) Lichenes orae Sibiriae borealis inde ab insula Minin usque ad promontorium Ryrkajpia in expeditione Vegae lecti. *Ark. Bot.* **25A**(2): 1-42.
- Magnusson, A. H. (1944) Studies in the *ferruginea*-group of the genus *Caloplaca*. *Göteborgs K. Vet. Vätt. Samh. Handl. Ser. 6 B.* **3**(1): 1-71.
- Magnusson, A. H. (1947) Studies in Non-Saxicolous Species of *Rinodina* mainly from Europe and Siberia. *Acta Horti Gothob.* **17**: 191-338.
- Magnusson, A. H. (1950) On some species of *Blastenia* and *Caloplaca* with black apothecia. *Bot. Not.* **3**: 369-386.
- Moberg, R. & Zhurbenko, M. P. (1994) *Physcia albinea* new to Asia. *Graphis Scripta* **6**: 35-36.
- Norin, B. N., ed. (1986) *Gornye fitotsenoticheskie sistemy Subarktiki*. Leningrad: Nauka.
- Nylander, W. (1867) Lichenes Middendorffiani. II. Lichenes e Taimyr et Boganida. In Middendorff, A. T. *Reise in den äussersten Norden und Osten Sibiriens, IV*. Part VI: 58 St.-Petersburg.
- Oxner, A. N. (1940-42) *Analiz i istoriya proiskhozhdeniya likhenoflory Sovetskoy Arktiki*. Unpublished manuscript. Kiev-Kirov.
- Oxner, A. N. (1971) *Aspicilia*. In *Handbook of the lichens of the U.S.S.R.* (I. I. Abramov, ed.) Vol. I: 146-217. Leningrad: Nauka.
- Piin, T. (1977a) A list of terricolous lichens of "forest island" of Ary-Mas. *Folia Cryptog. Estonica* **8**: 3-8.
- Piin, T. (1977b) The new terricolous lichen from Taimyr Peninsula - *Biatorella contigua* Golubk. & Piin species nova. *Folia Cryptog. Estonica* **7**: 1-3.
- Piin, T. (1979a) Napochvennye lishayniki mysa Chelyuskin. In *Arkticheskie tundry i polyarnye pustyni Taymyra* (V. D. Alexandrova & N. V. Matveeva, eds.): 61-73. Leningrad: Nauka.

- Piin, T. (1979b) Napochvennye lishayniki okrestnostey bukhty Marii Pronchishchevoy (severo-vostochnyy Taymyr). In *Arkticheskie tundry i polyamye pustyni Taymyra* (V. D. Alexandrova & N. V. Matveeva, eds.): 140-143. Leningrad: Nauka.
- Piin, T. (1984) Flora and distribution of terricolous lichens in the southern tundra of Taymyr. In *Flora and groupings of lower plants in natural and anthropogenous extreme environment conditions* (J. Martin, ed.): 134-172. Tallinn: Acad. Sci. Eston. SSR.
- Piin, T. & Martin, J. (1978) Flora napochvennykh lishaynikov. In *Ary-Mas* (B. N. Norin, ed.): 101-123. Leningrad: Nauka.
- Piin, T. & Trass, X. (1971) The lichens growing on the soil surface in the vicinity of Tareya (western Taymyr). In *Biogeocenoses of Taymyr tundra and their productivity* (B. A. Tikhomirov, ed.): 151-159. Leningrad: Nauka.
- Poelt, J. & Zhurbenko, M. P. (1994) *Lecanora gyrophorina* spec. nov. eine bemerkenswerte, auf einer Nabelflechte schmarotzende parasitische Lichene. Unpublished manuscript. Graz - St.-Petersburg.
- Pospelova, E. B. (1974) Struktura i prostranstvennoe raspredelenie rastitel'noy massy v osnovnykh rastitel'nykh soobshchestvakh statsionara "Agapa". In *Pochvy i produktivnost' rastitel'nykh soobshchestv* (V. A. Kovda, ed.), Part 2: 48-66. Moscow: Moscow State University.
- Savicz, V. P. (1916) Les Lichenes des cotes polaires de la Siberie recueillis par. M-r I. I. Trchemesky. *Izv. Imp. S.-Peterburgsk. Bot. Sada* **16**(1): 133-155.
- Savicz, V. P. & Elenkiñ, A. A. (1950) Vvedenie k flore lishaynikov Aziatskoy chasti SSSR. *Trudy Bot. Inst. Akad. Nauk S.S.S.R., Ser. 2* **6**: 181-343.
- Sambuk, F. V. (1937) Brief survey of the vegetation on the Taymyr Peninsula. *Problems of the Arctic (Chief administration of the northern sea route, Leningrad)* **1**: 127-153.
- Santesson, R. (1993) *The lichens and lichenicolous fungi of Sweden and Norway*. Lund.
- Shchelkunova, R. P. (1979) Accretion of fodder lichens and their distribution in Northern Yenisey region. *Bot. Zhurn. (Moscow & Leningrad)* **64**: 1111-1121.
- Søchting, U., Zhurbenko, M. P. & Hansen, E. S. (1992) Notes on the genus *Caloplaca* in the Siberian Arctic. *Graphis Scripta* **4**: 30-32.
- The Times Atlas of the World*. (1990) 8th Edn. London: Times Books.
- Thomson, J. W. & Bird, C. D. (1978) The lichen genus *Dactylina* in North America. *Canad. J. Bot.* **56**: 1602-1624.
- Titov, A. N. (1984) Lichenes Caliciales in parte borealioccidentali planitie Putorana. *Novosti Sist. Nizsh. Rast.* **21**: 179-183.
- Tolmatchev, A. I. & B. A. Yurtsev, eds. (1960-1987) *Flora Arctica URSS*. Fasc. I-X. Leningrad: Nauka.
- Treshnikov, A. F., ed. (1985) *Atlas Arktiki*. Moscow: GUGK.
- Tyulina, L. N. (1937) Forest vegetation of the Khatanga district along its north boundary. *Trudy Arktich. Inst., Leningrad* **63**: 83-180.

- Vinogradova, A. N. (1937) Geobotanical outline of the reindeer ranges along the Piassina River. *Trudy Arktich. Inst., Leningrad* **63**: 5-45.
- Yurtsev, B. A., Tolmatchev, A. I. & Rebristaya, O. V. (1978) The floristic delimitation and subdivision of the Arctic. In *The Arctic Floristic Region* (B. A. Yurtsev, ed.): 9-104. Leningrad: Nauka.
- Zhurbenko, M.P. (1989) Materies ad lichenofloram planitiei elatae Putorana. *Novosti Sist. Nizsh. Rast.* **26**: 110-116.
- Zhurbenko, M. P. (1992a) Lichens from the coast of Eniseiskii Gulf, W. Taimyr, Siberia. *Graphis Scripta* **4**: 1-4.
- Zhurbenko, M. P. (1992b) The new and rare species of lichens from the north-western part of the Putorana plateau. *Bot. Zhurn. (Moscow & Leningrad)* **77**(3): 108-114.
- Zhurbenko, M. P. (1993a) Lichens from the region of northern extremity of Piasino Lake, Taymyr. In *Proceedings IV Youth Conference Botanists (St.-Petersburg 1992)*. Part 5. Manuscript is deposited in VINITI, No 1625-B93.
- Zhurbenko, M. P. (1993b) De distributione lichenum per altitudines varias in parte boreali-occidentali planitiei elatae Putorana (Subarctica Sibirica). *Novosti Sist. Nizsh. Rast.* **29**: 107-114.
- Zhurbenko, M. P. Lichens from the Lower Right Uboynaya River, W. Taymyr. *Novosti Sist. Nizsh. Rast.* **30** (in prep.).
- Zhurbenko, M. P. & Hansen, E. S. (1992) New, rare or otherwise interesting lichen species from the Siberian Arctic. *Mycotaxon* **45**: 278-284.
- Zhurbenko, M. P. & Hansen, E. S. (1993) *Lecanora geophila* and *Arctopeltis thuleana* (Lichenes) from the Siberian Arctic. *Bot. Zhurn. (Moscow & Leningrad)* **78**(5): 125-127.
- Zhurbenko, M. P. & Poelt, J. (1994) On some new and interesting lichen species from the Putorana Plateau, Northern Siberia. Unpublished manuscript. Graz - St.-Petersburg.
- Zhurbenko, M. P. & Santesson, R. (1995) On lichenicolous fungi from the Russian Arctic: I. *Mycotaxon* (in prep.).
- Zhurbenko, M. P. & Søchting, U. (1993) *Caloplaca tornöensis* and *Caloplaca spitsbergensis* (Lichenes), the two lichen species from the Taimyr Peninsula new to Russia. *Bot. Zhurn. (Moscow & Leningrad)* **78**(2): 118-120.

***SCUTELLINIA TOTARANUIENSIS* SPEC. NOV.,
A NEW SPECIES FROM NEW ZEALAND
(DISCOMYCETES, PEZIZALES).**

Jiří Moravec,

P. O. Box 17/A, CZ-679 04 ADAMOV u Brna, Czech Republic.

ABSTRACT: A new species of the genus *Scutellinia* (Cooke) Lamb. based on a collection from New Zealand made by the author is described under the name *Scutellinia totaranuiensis* spec. nov. The new species is compared to *Scutellinia geneospora* (Berk.) O. Kuntze and to *Scutellinia phymatodeus* S. C. Kaushal & R. Kaushal for the similarly apiculate ascospores of the former and similar tuberculate ascospore ornamentation of the latter. The examination of the type material of these taxa has confirmed mutually different characteristics. Relations to several other species of the genus are also discussed. Another 6 species of *Scutellinia* are reported from New Zealand for the first time. Notes on the taxonomy, line drawings of the main features of *S. totaranuiensis* and *S. geneospora* as well as SEM of ascospores accompany the paper.

***Scutellinia totaranuiensis* spec. nov.**

Apothecia 2-5 mm diam., aggregata, sessilia, orbicularia, primum patellaria, dein subexplanata, hymenio aurantiaco-rubro, marginem et extus pilis brevis, fuscis dense obsita. Pili brevi, 60-270(-285) x 12-21.5 µm, fusci, rigidi, crasse tunicati (parietibus 3-4.5 µm crassis), sparse (1-3) septati, recti vel saepe curvati, supra acuti, basi attenuati, breviter bifurcato-radicati vel saepe simplices, truncati vel angustati et saepe subacuti (pili bicuspidati). Excipulum externum e textura globuloso-angulari, parte inferiore (medulla) textura intricata. Asci 250-280 x 10-12 µm, cylindranei, octospori. Ascosporae 13.5-16.5(-17.6) x 7.5-10.5(-11) µm (ornamento excluso), ellipsoideae, irregulariter multiguttulae, crasse tuberculoso-verrucosae, ad polis apiculatae. Paraphyses filiformes, 2-3 µm diam., apice non vel sensim (ad 3.5-7.5 µm incrassatae, granulis aurantiacis impletae.

Habitat: Ad terram humidam argillaceo-arenosam viae silvaticae (*Metrosideros* sp.) in densa societate *Pezizae badioconfusae*, New Zealand, South Island, Abel Tasman Coastal Track, Totaranui prope Takaka, 6. III. 1993 leg. Jiří Moravec - holotypus in BRNM 599298, isotypi in CUP, WELTU et J.Mor. asservantur.

Apothecia 2-4(-5) mm diam., gregarious, sessile, rounded, cupulate, then shallowly cupulate to almost discoid, hymenium pale to dark orange-red, outer surface and margin densely covered by very short, dark brown hairs. **Hairs** short, 60-270(-285) x 12-21.5 μm , light to dark brown, rigid, thick-walled (walls 3-4.5 μm thick), usually 1-3 septate, straight or often curved or flexuous, acuminate above, narrowing towards the base; the base bifurcate to short and narrow roots or usually simple, truncate, or usually attenuated to a subacute end of a similar shape like the upper acute part ("bicuspidate"). **Excipulum** clearly differentiated: ectal excipulum of textura globulosa-angularis comprising hyaline, large, subglobose to angular cells which are 20-75 μm in diam. and elongated and clavate in the margin of the apothecia; medullary excipulum of textura intricata, comprising interwoven, septate, usually inflated hyphae (6-15 μm in diam.) which grade towards smaller hyphae of the indistinctly differentiated subhymenium. **Asci** 250-280 x 10-12 μm , cylindrical, rounded above, operculated, attenuated towards the simple base, eight-spored. **Ascospores** ellipsoid, 13.5-16.5(-17.6) x 7.5- 10.5(-11) μm (excluding the ornamentation and apiculi), usually 16 x 9 μm but also 15 x 10.5 μm , containing several guttules which are of an unequal size, ornamented by large cyanophilic warts and tubercles which measure 1.5-4.5 μm and are mostly rounded, isolated or occasionally mutually attached or connected by thin buckles; on the ascospore poles, the cyanophilic tubercles are usually arranged inside irregular appendages as they are coated by an outermost sheath, forming thus conspicuous apiculi which are up to 10.5 μm high (oil immersion and stained by CB Geigy s. 123 without heating the slides). **Paraphyses** filiform, 2-3 μm thick, not or slightly enlarged to 3.5-7.5 μm at their tips, containing orange granules.

Holotype: New Zealand, South Island, Abel Tasman Coastal Track, Totaranui near Takaka, on moist clayey-sandy soil on a path through a sea-side forest (*Metrosideros* sp.), closely associated with apothecia of *Peziza badioconfusa* Korf, 6. III. 1993 leg. Jiří Moravec. (The holotype BRNM 599298, isotypes CUP, WELTU, J.Mor.).

The new species is well characterized by its small apothecia having the outer surface and the margin densely covered by very short brown hairs, which, especially those in the lower part of the excipulum, are occasionally attenuated towards a subacute base, and thus, they may resemble the hairs in the genus *Trichophaeopsis* Korf & Erb. The most remarkable feature of the new species are the apiculate ascospores possessing tuberculate ornamentation.

In the genus *Scutellinia* (Cooke) Lamb., recently monographed by Schumacher (1990), we can find similarly apiculated ascospores in *Scutellinia geneospora* (Berk.) O. Kuntze - a rare species known only from India, Indonesia and Japan. However, the examination of the holotype (K, as *Peziza geneospora* Berk.) has revealed that the Asian species is clearly distinguished by much longer and wider hairs and also by much larger ascospores. The hairs of the holotype measure (110-)400-955 x 22-45 μm , and the mature ascospores measure (18-) 21-24.5 (-25.5) x 12-15(-16) μm (excluding the ornamentation and apiculi). Moreover, the ascospore warts are mostly of a more irregular shape, and the space inside the cyanophilic sheath of the follicle-like apiculi is often conspicuously transparent.

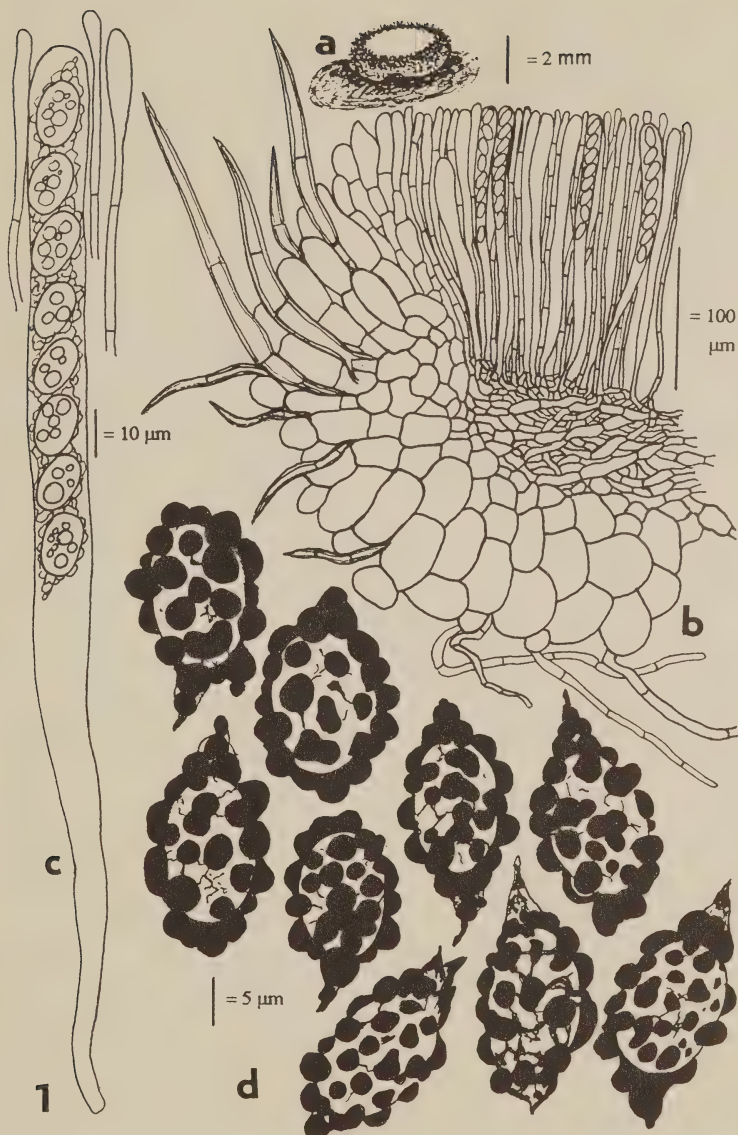


Fig. 1. *Scutellinia totaranuiensis* sp. nov.: **a.** apothecium; **b.** section of the marginal part of the apothecium; **c.** ascus and paraphyses; **d.** ascospores under oil immersion + CB. - Holotype (BRNM).



Fig. 2. *Scutellinia totaranuiensis* sp. nov.: hairs. - Holotype (BRNM).

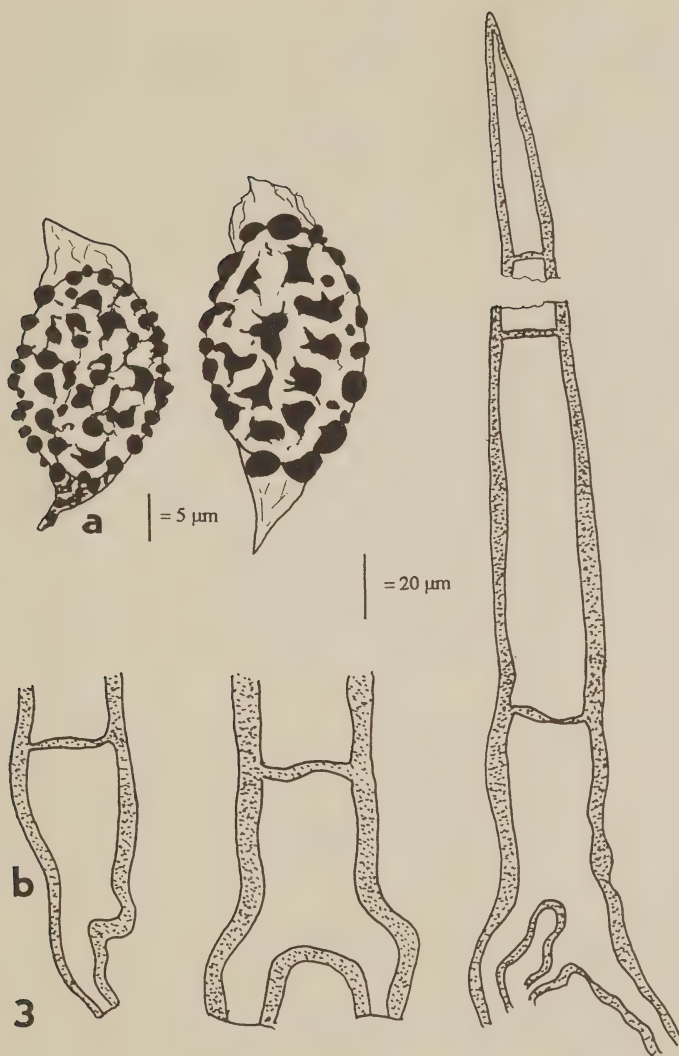


Fig. 3. *Scutellinia geneospora* (Berk.) T. Schum.: a. ascospores under oil immersion + CB; b. base of hairs and a hair. - Holotype (K).

However, in a certain number of ascospores of both species a similar type of apiculi occurs and thus we may speculate whether these two species may be accommodated in the same section of the genus *Scutellinia*, supposedly in the section *Geneospermae* (Rifai) T. Schumacher (1990) which, after the Schumacher's recombination, replaced the previously erected genus *Geneosperma* Rifai (1968). However, the taxonomic value of the similar type of ascospores of these two species, which is a leading character for such supposition, is decreased by another important feature - the very different size and shape of hairs. *S. totaranuiensis* has therefore an outstanding position in the genus.

Nevertheless, also several features of *Scutellinia phymatodeus* S. C. Kaushal & R. Kaushal in S. C. Kaushal, R. Kaushal & Ravla (1983), particularly the short hairs and similar tuberculate ascospore ornamentation, may indicate a close relationship to *S. totaranuiensis*. However, the reexamination of the isotype (J.Mor.) has confirmed that *S. phymatodeus*, which is known only from the type collection made in India, is well differentiated. The Indian species is remarkable by extremely short apothecial hairs which measure $45-135 \times 10.8-12(-16.3) \mu\text{m}$, and by the ascospores which measure $15-16.5(-18) \times 10.8-12(-13) \mu\text{m}$, are ornamented by larger and more spherical tubercles and possess no apiculi (there are only enlarged tubercles on the ascospore poles). [Compare also the illustrations and discussion in Cao & J.Moravec (1988)].

S. phymatodeus and also *Scutellinia ahmadi* (Cash) S. C. Kaushal in S. C. Kaushal, R. Kaushal et Ravla (1983), of which the type (K) has also been examined, represent species with the shortest apothecial hairs within the genus *Scutellinia*.

Also *Scutellinia pseudotrechispora* (Schröt.) Le Gal (1962) may resemble *S. totaranuiensis* in having similar type of short curved hairs and apiculate ascospores. The ascospores are, however, much larger and possess a perisporium covered by a conspicuously reticulate ornamentation. Schumacher (1990) accommodated *S. pseudotrechispora* into his series *Pseudotrechisporae* (Svr.) T. Schum. of the section *Minutae* Svr. Notwithstanding, this species has an outstanding position in the genus. Svrček (1948) erected even an independent genus *Melastiziella* Svrček (1948) based on *Humariella pseudotrechispora* Schröt., and later, the section *Pseudotrechisporae* Svrček (1971) of the genus *Scutellinia*. The supposition of a more important position of *S. pseudotrechispora* within the genus *Scutellinia* and that it may be more isolated than stated by Schumacher (1990), is supported by recently published results of ultrastructure studies of the ascospore wall made by Brummelen (1993). In my opinion, similarly, the infrageneric position of *S. totaranuiensis* and *S. geneospora* can be cleared by further studies on the genus.

During my stay on New Zealand, 7 other species of the genus *Scutellinia* were collected by me. Besides *Scutellinia scutellata* (L.: Fr.) Lamb., the following 6 species, as far as I know, have not hitherto been reported from New Zealand. All of them were collected on the North Island, near Whakapapa Willage in the Tongariro National Park, district of Waiouri, in a forest of *Nothofagus* sp. (leg. J. Moravec and the material of all the collections is deposited in J.Mor. and CUP).

These are:

Scutellinia cejpai (Velen.) Svr. - on moist soil, 18. II. 1993;

Scutellinia crinita (Bull.:Fr.) Lamb. - on soil and decaying roots and wood, 18. II. 1993;

Scutellinia crucipila (Cooke et Phill. in Cooke) J.Mor. - on soil mixed with decaying twigs and leaves, 20. II. 1993;

Scutellinia nigrohirtula (Svr.) Le Gal - on damp sandy soil mixed with decaying twigs, roots and leaves, 20. II. 1993;

Scutellinia olivascens (Cooke) O. Kuntze - on decaying wood mixed with soil on the ground, 18. II. 1993;

Scutellinia marginata Gamundí - on damp soil mixed with remnants of wood and leaves, 20. II. 1993.

Regarding *S. marginata*, Schumacher (1990) considered this taxon identical with *Scutellinia torrentis* (Rehm) T. Schum. However, the reexamination of the type (K) of *Lachnea torrentis* Rehm revealed a much finer ornamentation of the ascospore perisporium. The collection from New Zealand possesses the same type of the separable perisporium which is characteristic for *S. torrentis* and other species of the section *Minutae* Svr. Nevertheless, the ascospore ornamentation of the New Zealand specimen is much coarser and more isolated and well agrees with that illustrated by Gamundí (1975) of *S. marginata*. The exact identification will be possible after the reexamination of the type of *S. marginata*. A further revision of all species of the section *Minutae* is also necessary.

ACKNOWLEDGEMENTS

I thank Dr. Brian B. Spooner and curators of the Kew herbarium (K) for arrangements of the loan of type material. I am also grateful to Dr. Zdeněk Pouzar (Prague) for reviewing the manuscript, to Dr. Mirko Svrček (Prague) for correcting the Latin diagnosis, and to Mr. Jiří Lhotecký (Brno) who kindly prepared the SEM photomicrographs. My special thanks belong to Dr. Ann Bell and Dr. Dan Mahoney for their support during my stay in New Zealand.

REFERENCES

- Brummelen J. van. (1993): Ultrastructure of the ascus and the ascospore wall in *Scutellinia* (Pezizales, Ascomycotina). - *Persoonia* 15 (2): 129-148.
- Cao J. & Moravec J. (1988): *Scutellinia fujianensis* sp. nov., a new species from China - *Mycol. Helvet.* 3 (2): 183-190.
- Denison W. C. (1964): The genus *Cheilymenia* in North America. - *Mycologia* 56: 718-737.
- Gamundí I. J. (1975): Fungi, Ascomycetes Pezizales. - *Fl. cript. de Tierra del Fuego* 10 (3): 1-184.
- Kaushal S. C., Kaushal R. & Ravla G. S. (1983): Genus *Scutellinia* from India, its taxonomy, nomenclature and affinities. - *Bibliotheca Mycologica* 91:583-608.

- Le Gal M. (1962): Combinaisons nouvelles concernant les genres *Galactinia* (Cooke) Boud. emend. Le Gal et *Scutellinia* (Cooke) Lamb. emend. Le Gal et *Sarcosoma* Casp.- Bull. Soc. mycol. Fr. 78: 204-216.
- Moravec J. (1990): Taxonomic revision of the genus *Cheilymenia* - 3. A new generic and infrageneric classification of *Cheilymenia* in a new emendation. - Mycotaxon 38: 459-484.
- Rifai M. A. (1968): The Australasian Pezizales in the Herbarium of the Royal Botanic Gardens Kew. - Vehr. Koninkl. Nederl. Akad. Wetensch. Nat. 57 (3): 1-295.
- Schumacher T. (1990): The genus *Scutellinia* (Pyronemataceae) - Opera Bot., Copenhagen, 101: 1-107.
- Svrček M. (1948): České druhy podčeledi Lachneoideae (čel. Pezizaceae). Bohemian species of Pezizaceae subf. Lachneoideae. - Sb. Nár. mus. Praha 4 B (6): 1-95.
- Svrček M. (1971): Tschechoslowakische Arten der Discomyzetengattung *Scutellinia* (Cooke) Lamb. emend. Le Gal (Pezizales) 1. - Čes. Mykol. 25: 77-87.

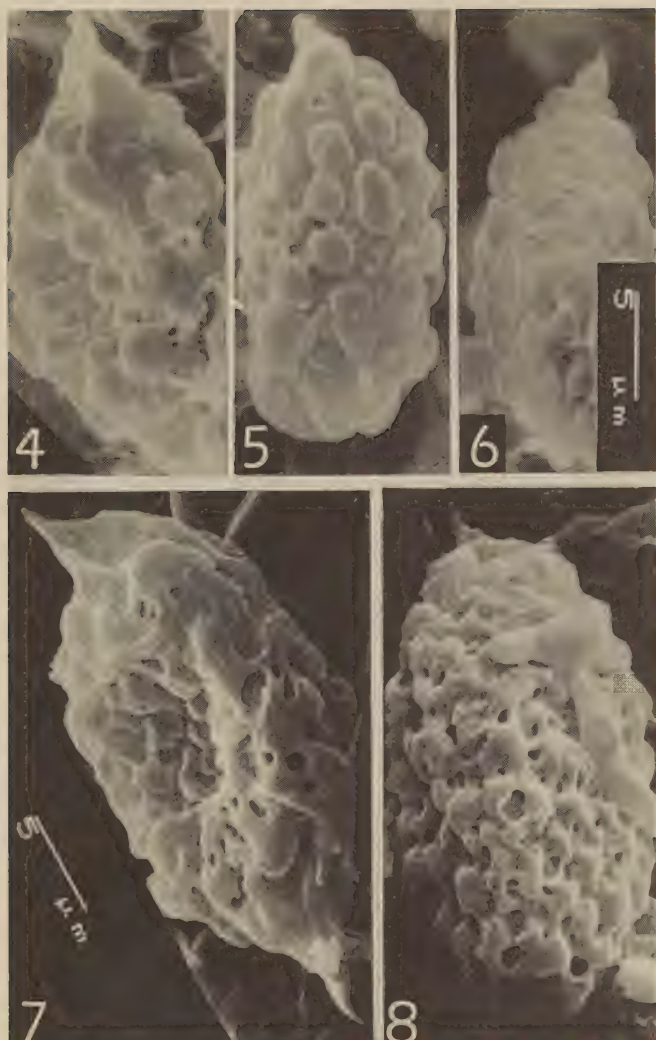


Fig. 4. - 8. SEM of ascospores:

4. - 6. *Scutellinia totaranuiensis* sp. nov. - Holotype (BRNM);

7. - 8. *Scutellinia geneospora* (Berk.) T. Schum. - Holotype (K)

NOTES ON CONIDIAL FUNGI. VII. TWO NEW SPECIES OF *BELTRANIELLA* FROM CUBA

R. F. Castañeda Ruiz¹, J. Cano² and J. Guarro²

¹ Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro Humboldt" (INIFAT) Calle 1 esq. 2 Santiago de las Vegas, Ciudad Habana, Cuba. ² Unitat de Microbiologia, Facultat de Medicina i Ciències de la Salut, Universitat Rovira i Virgili, 43201 Reus, Tarragona, Spain.

ABSTRACT

Two new hyphomycetes, *Beltraniella amoena* and *B. clavatophora* anam.sp.nov., from leaf litter in Cuba are described, illustrated and discussed. In the former, conidia are obovoid to narrowly turbinate, hyaline, without a distinctive transverse band and with clavate separating cells; the latter has peculiar conidiophores, which are always clavate at the apex, and conidia with a hyaline transverse band and two pores near the distal end. A key to the species of the genus is provided.

Key words: *Beltraniella*, hyphomycetes, litter fungi, tropical fungi, hyphomycetes, systematics

RESUMEN

Se describen, ilustran y discuten las nuevas especies *Beltraniella amoena* y *B. clavatophora*. La primera se caracteriza por poseer conidios de obovoides a estrechamente turbinados, hialinos, sin una banda transversal y con células separadoras claviformes; la última tiene conidióforos mazudos en el ápice y conidios con una banda transversal hialina y dos poros cerca del extremo distal. Se presenta una clave para la identificación de las especies del género.

Palabras clave: *Beltraniella*, hyphomycetes, hongos tropicales, sistemática.

Beltraniella amoena Castañeda Ruiz, Cano et Guarro anam. sp. nov. (Fig. 1,2)

Etym.: *amoena* - beautiful.

Ad fungos conidiales, hyphomycetes pertinens. **Coloniae** punctiformes, effusae, amphigenae, ochraceae vel olivaceo-brunneae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, brunneis, 1.5 - 2 μm diam. compositum. **Setae** erectae, rectae, cylindricae, rotundae vel obtusae ad apicem, eramosae, 3 - 5 septatae, subtiliter verrucosae, brunneae ad fundamentae, infra dilute brunneae, 120 - 160 μm altae, 14 - 18 μm crassae ad basim, ex cellulis basalibus brunneis, radiatim lobatis, oriundae. **Conidiophora** conspicua, mononematosa, fasciculata, erecta, ramosa, septata, levia, dilute brunnea, 40 - 60 x 4 - 9 μm (ad basim). **Cellulae conidiogenae** polyblasticae, sympodiales, discretae, terminales, clavatae usque cylindricae, interdum irregulare curvatae et inflatae, denticulatae, dilute brunneae, 7 - 18 x 3 - 5 μm . **Cellulae separantes** clavatae, attenuatae et truncatae ad basim, laeves, hyalinae, 15 - 17 x 3 - 5 μm , persistentes ad basibus conidiis, visae. **Conidia** obovoidea usque anguste turbinata, leviter attenuata ad basim, rotunda vel subtruncata ad apicem, unicellularia, levia vel subtiliter verrucosa, solitaria, sicca, hyalina, 19 - 25 x 5 - 6.5 μm , generaliter transversalia fasciata sed interdum vel raro inconspicua fasciata supraequatoria zona.

Conidial fungi, hyphomycetes. **Colonies** punctiform, spreading, amphigenous, ochraceous to olive-brown. Mycelium immersed and superficial. Hyphae septate, branched, smooth, brown, 1.5 - 2 μm diam. **Setae** straight, cylindrical, upright, rounded to obtuse at the apex, unbranched, 3-5 septate, finely verrucose, brown at the base, pale brown at the apex, 120 - 160 x 14 - 18 μm (at the base), arising from a radially lobed basal cell. **Conidiophores** differentiated, mononematous, fasciculate, upright, branched, septate, smooth, pale brown, 40 - 60 x 4 - 9 μm (at the base). **Conidiogenous cells** polyblastic, sympodial, discrete, terminal, clavate to cylindrical, sometimes irregularly curved and inflated, denticulate, pale brown, 7 - 18 x 3 - 5 μm . **Separating cells** clavate, base tapered and truncate, smooth-walled, hyaline, 15 - 17 x 3 - 5 μm , often remaining attached on the conidial base. **Conidia** obovoid to narrowly turbinate, slightly tapered at the base, apex rounded or subtruncate, unicellular, smooth or finely verrucose, solitary, dry, hyaline, 19 - 25 x 5 - 6.5 μm , sometimes with granular protoplasm, usually without a transverse band, but with an inconspicuous transverse band above the equatorial zone.

Habitat: On fallen dead leaves of unidentified *Lauraceae*, Gran Piedra, Santiago de Cuba, Cuba.

Holotype: INIFAT C94/149, R. F. Castañeda, 2 November 1994.

Cultures ex type: MUCL 39129 (Mycothèque Université Catholique de Louvain); CBS 182.95.

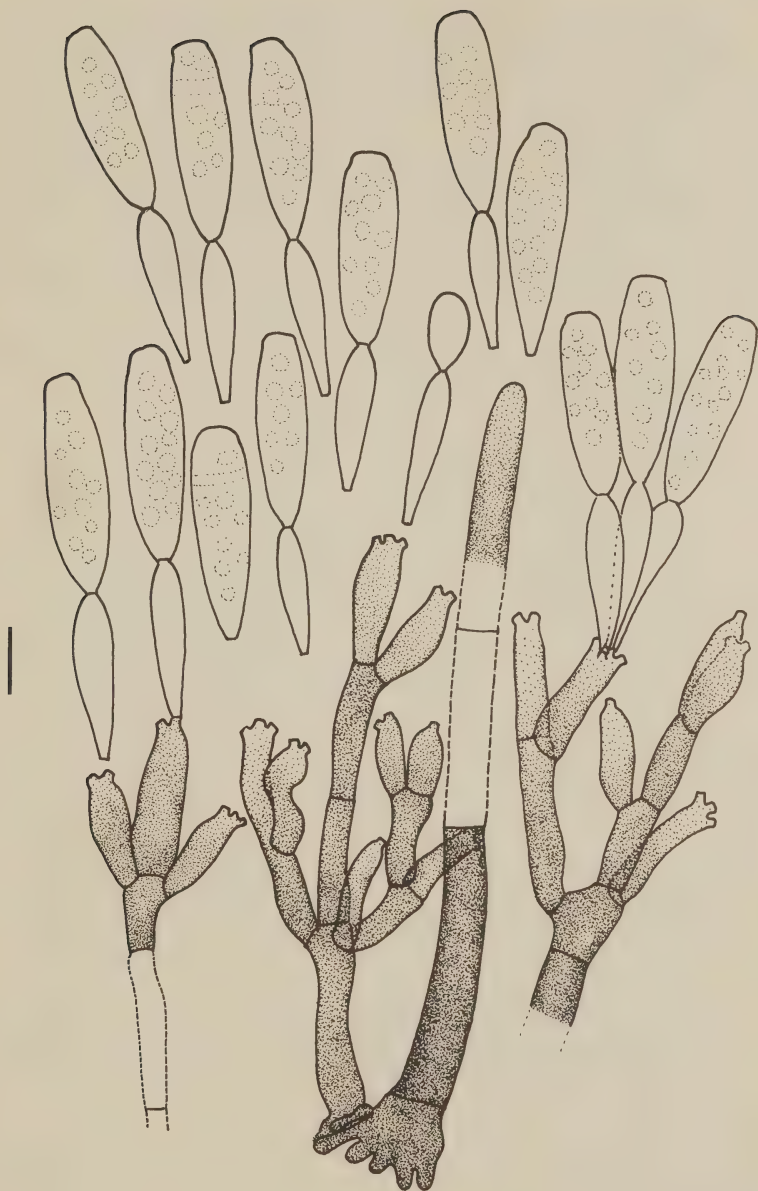


Fig. 1- *Beltraniella amoena* (INIFAT C94/149). Conidiophores and conidia (bar =10 μ m)

B. amoena is clearly differentiated from other species of *Beltraniella* with similar conidial shape and pigmentation such as *B. porosa* Pirozynski & Patil (1970), *B. pirozynskii* P.M. Kirk (1981), *B. clara* Onofri (1983), *B. lyrata* Rambelli & Ciccarone (1985) and *B. peruamazonica* Matsushima (1993); all these species have setiform conidiophores, whereas *B. amoena* has distinctive setae. The former species are also distinguished from *B. amoena* by their separating cells, which are absent (in *B. pirozynskii* and *B. clara*) or of different shape, i.e.: fusiform (*B. lyrata* and *B. peruamazonica*) or ellipsoid (*B. porosa*). Other species such as *B. ondinae* Subramanian (1952) (type species), *B. humicola* Ramarao (1962), *B. spiralis* Pirozynski & Patil (1966), *B. portoricensis* (F.L. Stevens) Pirozynski & Patil (1970), *B. nilgirica* Pirozynski & Patil (1970), *B. buloloensis* Matsushima (1971), *B. pini* Ellis (1972), *B. japonica* Matsushima (1975), *B. aethiopica* Bhat & Sutton (1985) and *B. havanensis* (Holubová-Jechová) Matsushima (1987) do not resemble *B. amoena* in their conidial and separating cell morphology.

Beltraniella clavatophora Castañeda Ruiz, Cano et Guarro anam. sp. nov.

Etym.: *clavatophora* - referring to the clavate shape of the conidiophores. (Fig. 2,3)

Ad fungos conidiales, hyphomycetes pertinens. **Coloniae** punctiformes, effusae, interdum confluentes, velutinae, amphigenae, olivaceo-brunneae. Mycelium plerumque in substrato immersum, ex hyphis septatis, ramosis, laevibus, brunneis, 1.5 - 3 μm diam., compositum. **Setae** deficientes. **Conidiophora** conspicua, mononematosa, setiformia, erecta, plerumque eramosa, raro ramosa, cylindrica ad basim, claviformia et inflata ad apicem, 4 - 9 septata, levia, brunnea ad basim, pallide brunnea ad apicem, 60 - 170 x 7 - 13 μm (ad fundamenta) et 4 - 5.5 μm (ad apicem), ex cellulis basalibus brunneis, radiatim lobatis, oriunda. **Cellulae conidiogenae** polyblasticae, sympodiales, denticulatae, lageniformes, discretiae, sessiles, brunneae vel pallide brunneae, leves, 8 - 10 x 5 - 6 μm , in verticillis circa et infra septi conidiophoris, dispositae. **Cellulae separantes** oboviformes, late ellipsoidales usque limoniformes, dilute brunneae, 7 - 10 x 4 - 5 μm . **Conidia** turbinata, subtruncata ad apicem, attenuata et rostrata ad basim, unicellularia, dilute brunnea, sicca, levia vel subtiliter verrucosa, 20 - 24 x 3.5 - 5 μm , suprazona incolorata transversa visa constricta (isthmo-similis), quasi semper cum 2 - poris utrinque praedita.

Conidial fungi, hyphomycetes. **Colonies** punctiform, spreading, sometimes confluent, velvety, amphigenous, olive-brown. Mycelium mostly immersed. Hyphae septate, branched, smooth, brown, 1.5 - 3 μm diam. **Setae** absent. **Conidiophores** differentiated, mononematous, setiform, upright, rarely branched, cylindrical at the base, clavate and capitate, 4 - 9 septate, smooth, brown at the base, pale brown at the apex, 60 - 170 x 7 - 10 μm (at the base), 4 - 5.5 μm (at the apex), arising from a brown radially lobed basal cell. **Conidiogenous cells** polyblastic, sympodial, denticulate, lageniform, discrete, sessile, brown to pale brown, smooth, 8 - 10 x 5 - 6 μm , arranged more or less in



Fig. 2.- *Beltramiella amoena* (INIFAT C94/149) **a**, conidiophores and conidiogenous cells, **b**, conidiogenous cells and conidia, **c**, conidia and separating cells; **d**, setae. *Beltramiella clavatophora* (INIFAT, C 94/49) **e**, conidiophores and conidia, **f**, conidiogenous cells, **g**, conidia (**a,b,c,d,f,g**, bar = 10 μ m; **e**, bar = 25 μ m).

verticils immediately below the septa of the conidiophore. **Separating cells** obovoid to limoniform, pale brown, 7 - 10 x 4 - 5 μm . **Conidia** turbinate, subtruncate at the apex, tapered and rostrate at the base, unicellular, pale brown, dry, smooth walled or finely verrucose, 20 - 24 x 3.5 - 5 μm ; distal zone with a hyaline, transverse, constricted (isthmus-like) band, with 2 conspicuous pores near the apex.

Habitat: On dead fallen leaves of *Manilkara zapota* (L.) D. Royen
Santiago de las Vegas, Ciudad de la Habana, Cuba.

Holotype: INIFAT C94 /49, R. F. Castañeda, 3, July 1994.

Cultures ex type: MUCL 39123 (Mycothèque Universite Catholique de Louvain); CBS 183.95.

B. pirozynskii and *B. clara* Onofri (1983) resemble *B. clavatophora*, but the first has tapering setiform conidiophores and very pale olivaceous conidia. Furthermore, separating cells have not been observed in this species. The second species has no pigmented conidiophores, conidiogenous cells or conidia; separating cells are lacking and conidia are different in size (18 - 20.5 x 5.5 - 7.5 μm).

KEY TO THE SPECIES OF *BELTRANIELLA*

- | | |
|--|-------------------------|
| 1.- Setae present..... | 2 |
| 1'- Setae absent..... | 5 |
| 2.- Setae spirally coiled or flexuous; conidia turbinate,
20-28 x 8.5-12 μm ; separating cells absent..... | <i>B. nilgirica</i> |
| 2'- Setae straight..... | 3 |
| 3.- Setae verrucose; conidia turbinate, 20-23 x 6.5-8 μm ;
separating cells limoniform, 9-12 x 4 μm | <i>B. portoricensis</i> |
| 3'- Setae smooth..... | 4 |
| 4.- Conidia biconic, pale olivaceous with a hyaline
transverse band, 20-40 x 8-10 μm ; separating cells
fusiform, 16-22 x 3-4 μm | <i>B. pini</i> |
| 4'- Conidia obovoid to narrowly turbinate, hyaline,
19-25 x 5-6.5 μm ; separating cells clavate, 15-17 x 3-5 μm | <i>B. amoena</i> |
| 5.- Conidiophores setiform..... | 6 |
| 5'- Conidiophores not setiform..... | 14 |
| 6.- Separating cells absent..... | 7 |
| 6'- Separating cells present..... | 8 |

- 7.- Conidia turbinate, without a transverse band,
18-20.5 x 5.5-7.5 μm *B. clara*
- 7'.- Conidia long-turbinate, with a hyaline
transverse band, 20-24.5 x 6-7 μm *B. pirozynskii*
- 8.- Conidia broadly pyriform, dark brown,
15-19 x 12-16 μm , with a hyaline transverse band;
separating cells globose *B. spiralis*
- 8'.- Conidia of different shape, hyaline, pale yellow,
or pale brown; separating cells not globose 9
- 9.- Conidia without a distinct transverse band 10
- 9'.- Conidia with a distinct transverse band 11
- 10.- Conidia with 4-5 circular pores near the centre,
pale brown, turbinate, 22-28 x 10-12 μm ;
separating cells ellipsoid, 12-14 x 5.5-7.5 μm *B. porosa*
- 10'.- Conidia without pores, hyaline to pale yellow, clavate,
20-29 x 9-11 μm ; separating cells fusiform *B. lyrata*
- 11.- Conidiophores verrucose; conidia narrow turbinate,
21-28 x 4-5 μm ; separating cells fusiform,
8-10 x 4-4.5 μm *B. peruamazonica*
- 11'.- Conidiophores smooth-walled 12
- 12.- Conidiophores clavate capitate;
conidia with 2 circular pores near the apex,
20-24 x 3.5-5 μm *B. clavatophora*
- 12'.- Conidiophores neither clavate nor capitate 13
- 13.- Conidia with a transverse hyaline band at the center,
long-turbinate, 18-25 x 6-8 μm ; separating
cells usually obovoid *B. ondinae*
- 13'.- Conidia with a transverse hyaline band above the center,
turbinate, 15-23 x 7-10 μm ; separating cells
usually fusiform *B. humicola*
- 14.- Conidiophores simple 15
- 14'.- Conidiophores branched 16
- 15.- Conidia navicular to turbinate, 20-40 x 14-18 μm ;
separating cells absent *B. buloloensis*
- 15'.- Conidia turbinate, 12-24 x 6-10 μm ; separating cells
rare, fusiform, 9-12 x 4-6 μm *B. havanensis*
- 16.- Conidiophores 125-300 μm long; conidia 13-19 x
8-9.5 μm , without a defined transverse band *B. japonica*
- 16'.- Conidiophores up to 460 μm long; conidia
15-24 x 6-8.5 μm , with a transverse hyaline band *B. aethiopica*

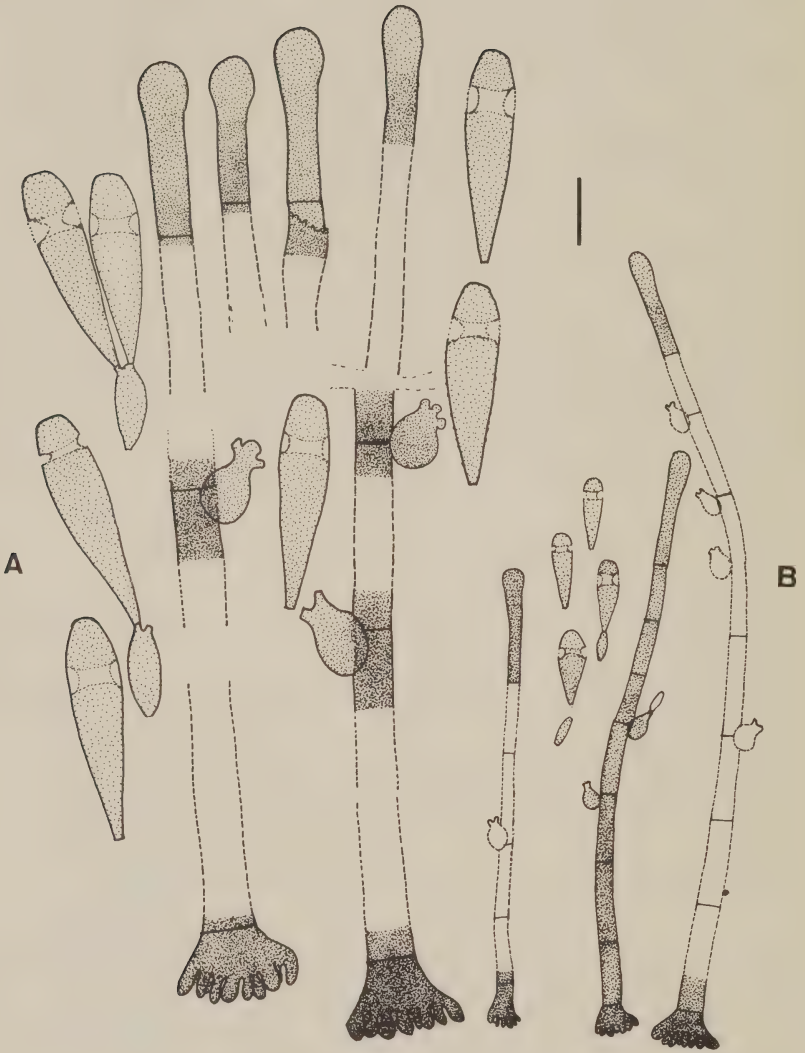


Fig.3.-*Beltraniella clavatophora* (INIFAT C 94/49). **a,b** conidiophores, conidiogenous cells and conidia (**a**, bar = 10 µm, **b**, bar = 25 µm)

ACKNOWLEDGMENTS

We are indebted to Dr. E. Descals (Inst. Estudis Avançats de les Balears, C.S.I.C.) for serving as pre-submission reviewer. We acknowledge the Cuban Ministry of Agriculture for providing facilities.

REFERENCES

- Bhat, D.J. and B.C. Sutton** (1985). New and interesting Hyphomycetes from Ethiopia. *Transactions of the British Mycological Society* **85**: 107-122.
- Ellis, M.B.** (1972). Dematiaceous Hyphomycetes. XI. *CMI Mycological Papers* **131**: 1-25.
- Kirk, P.M.** (1981). New or interesting microfungi. III. A preliminary account of microfungi colonizing *Laurus nobilis* leaf litter. *Transactions of the British Mycological Society* **77**: 457-473.
- Matsushima, T.** (1971). *Microfungi of the Solomon Islands and Papua-New Guinea*. Kobe. Matsushima.
- Matsushima, T.** (1975). *Icones microfungorum a Matsushima lectorum*. Kobe. Matsushima.
- Matsushima, T.** (1987). *Matsushima Mycological Memoirs*. 5. Kobe. Matsushima.
- Matsushima, T.** (1993). *Matsushima Mycological Memoirs*. 7. Kobe. Matsushima.
- Onofri, S.** (1983). A new *Beltraniella* species from forest litter. *Mycotaxon* **17**: 242-246.
- Pirozynski, K.A. and S.D. Patil** (1966). A new species of *Beltraniella* from India. *Nova Hedwigia* **11**: 199-201.
- Pirozynski, K.A. and S.D. Patil** (1970). Some setose Hyphomycetes of leaf litter in south India. *Canadian Journal of Botany* **48**: 567-581.
- Ramarao, P.** (1962). *Beltraniella humicola* sp. nov. *Current Science* **31**: 479-480.
- Rambelli, A. and C. Ciccarone** (1985). Two new dematiaceous Hyphomycetes from humid tropic forest litter. *Giornale Botanico Italiano* **119**: 291-294.
- Subramanian, C.V.** (1952). Fungi Imperfecti from Madras. III: *Beltraniella* gen.nov. *Proceedings of the Indian Academy of Science B* **36**: 223-228.

NOTES ON CONIDIAL FUNGI. VIII. TWO NEW SPECIES OF *DACTYLARIA* FROM CUBA

R. F. Castañeda Ruíz¹, J. Guarro² and J. Cano²

¹ Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro Humboldt" (INIFAT) Calle 1 esq. 2 Santiago de las Vegas, Ciudad Habana, Cuba. ² Unitat de Microbiologia, Facultat de Medicina i Ciències de la Salut, Universitat Rovira i Virgili, 43201 Reus, Tarragona, Spain.

ABSTRACT

Dactylaria filiformis anam. sp. nov., with filiform, aseptate, hyaline conidia, collected on a dead leaf of *Nectandra antillana* and *D. obclavata* anam. sp. nov. with obclavate, 3-septate, subhyaline conidia, found on dead leaves of *Ficus elastica* are described, illustrated and discussed. Both were collected in Cuba.

Key words: *Dactylaria*, hyphomycetes, litter fungi, tropical fungi, systematics

RESUMEN

Se describen, ilustran y discuten las nuevas especies *Dactylaria filiformis* y *D. obclavata*. La primera se caracteriza por poseer conidios hialinos, filiformes y sin septos; los de la segunda son obclavados, con tres septos y subhialinos; se encontraron sobre hojas muertas de *Nectandra antillana* y *Ficus elastica* respectivamente. Ambas proceden de Cuba.

Palabras clave: *Dactylaria*, hyphomycetes, hongos tropicales, sistemática.

Dactylaria filiformis Castañeda, Guarro et Cano anam. sp. nov. (Fig. 1,2)

Etym: *filiformis*, referring to the conidial shape

Coloniae effusae, pilosae, amphigenae, brunneae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, brunneis, 1-1.5 μm diam., compositum. **Conidiophora** conspicua, mononematosa, subulata, eramosa, erecta, cylindrica ad apicem, lata ad basim, brunnea ad fundamenta, subhyalinae ad apicem, 0-1 septata, 10-25 x 3-4 μm . **Cellulae conidiogenae** polyblasticae, terminales, sympodiales, in conidiophoris incorporatae, subhyalinae, denticulatae; denticulis conspicuis, breve cylindricis, praeditae. **Conidia** filiformia, unicellularia, levia, sicca, hyalina, 15-22 x 1 μm .

Teleomorphosis ignota.

Colonies spreading, hairy, amphigenous, brown. Mycelium superficial and immersed. Hyphae septate, branched, smooth, brown, 1-1.5 μm diam. **Conidiophores** differentiated, mononematous, subulate, unbranched, erect, straight, broad at the base, cylindrical towards the apex, smooth, pale brown at the base, subhyaline at the apex, 0-1 septate, 10-25 x 3-4 μm . **Conidiogenous cells** polyblastic, terminal, sympodial, integrated, denticulate; with conspicuous, short cylindrical denticles, subhyaline. **Conidia** filiform, aseptate, smooth, hyaline, 15-22 μm .

Teleomorph unknown.

Holotype: INIFAT, C94/32-1, on decaying leaf of ***Nectandra antillana*** Meisn. Jaruco, Ciudad de la Habana, Cuba, R. F. Castañeda, 28 September 1994. Isotype: MUCL 39183 (Mycothèque Université Catholique de Louvain, Belgium).

D. filiformis resembles ***D. scolecospora*** P.M. Kirk (1983) in its conidial morphology, but in the latter the conidia are longer (30-45 μm long) and the conidiophores are absent. The genus ***Dactylaria*** has been enlarged with several species (de Hoog, 1985; Castañeda and Kendrick, 1991) but none of the previously described species resemble ***D. filiformis***.

Dactylaria obclavata Castañeda, Cano et Guarro anam.sp. nov. (Fig.2,3)

Etym: *obclavata*, referring to the conidial shape

Coloniae effusae, pilosae, luteae, usque brunneae, hypophyllae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, eramosis, laevibus, brunneis, 2-3 μm diam., compositum. **Conidiophora** conspicua, mononematosa, cylindrica, simplicia, levia, 1-7 septata, brunnea ad basim,

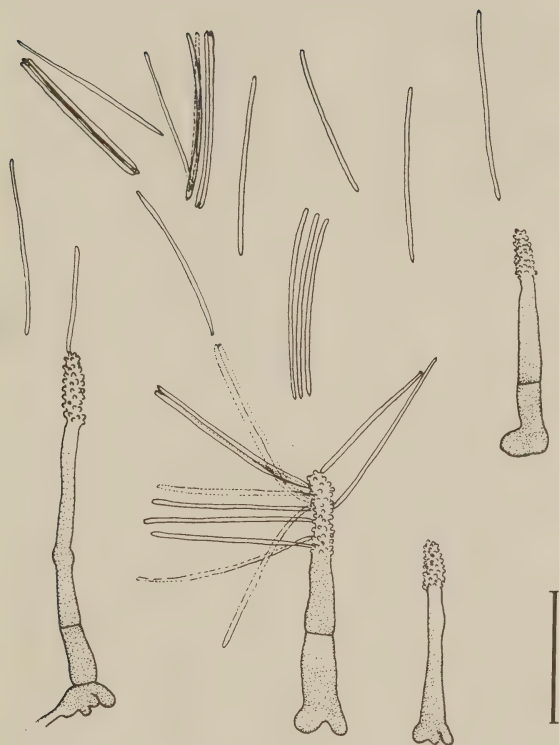


Fig.1- *Dactylaria filiformis* (INIFAT C94/32-1). Conidiophores and conidia (bar=10 μ m)



Fig 2- *Dactylaria obclavata* (INIFAT C94/43) a, conidiophores and conidia. b, conidia. *Dactylaria filiformis* (INIFAT C94/32-1). c, conidiophores and conidiogenous cells; d, conidia (a, bar = 25 μm; b,c,d, bar = 10 μm).

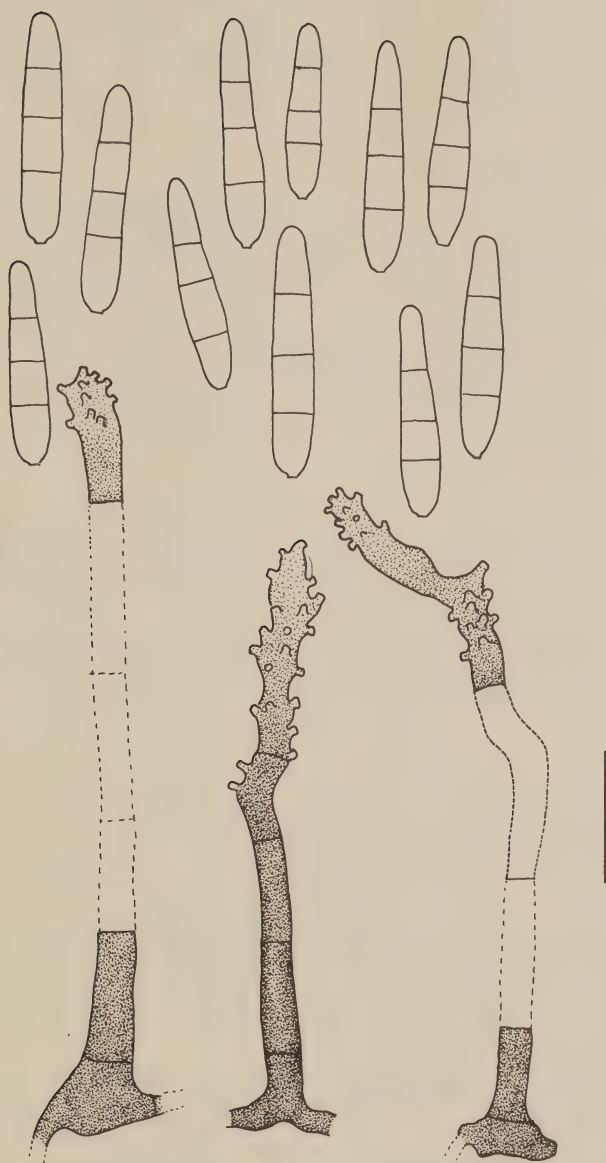


Fig.3- *Dactylaria obclavata* (INIFAT C94/43). Conidiophores and conidia (bar=10 μ m)

pallida brunnea ad apicem, 20-120 x 4-7 µm (ad basim). Cellulae conidiogenae polyblasticae, denticulatae cum denticulis conspicuis, cylindricis praeditae, in conidiophoris incorporatae, terminales, sympodiales, dilute brunneae; 14-25 x 3 µm. Conidia obclavata, interdum cylindrica, obtusa vel rotunda ad apicem, plerumque 3-septata, rarissima 2-septata, levia, sicca, dilute brunnea usque subhyalina, 15-21 x 2-3 µm.

Teleomorphosis ignota.

Colonies spreading, hairy, yellow to brown, hypophyllous. Mycelium immersed and superficial. Hyphae septate, unbranched, smooth, brown, 2-3 µm diam. **Conidiophores** differentiated, mononematous, cylindrical, simple, smooth, 1-7 septate, brown at the base, pale brown at the apex, 20-120 x 4-7 µm (at the base). **Conidiogenous cells** polyblastic, denticulate, with conspicuous cylindrical denticles, integrated, terminal, sympodial, pale brown, 14-25 x 3 µm. **Conidia** obclavate, sometimes cylindrical, obtuse to rounded at the apex, 3-septate, rarely 2-septate, smooth-walled, dry, pale brown to subhyaline, 15-21 x 2-3 µm.

Teleomorph unknown.

Holotype: INIFAT, C94/43, on decaying leaves of *Ficus elastica* Roxb.: Hornem. Santiago de las Vegas, Ciudad de la Habana, Cuba, R. F. Castañeda Ruiz, 4 January 1994. Isotype: MUCL 39195 (Mycothèque Université Catholique de Louvain).

D. obclavata resembles the *Dactylaria* sp. published and illustrated in Matsushima (1971, pp.20; fig.36, 3-4); but the conidia of this fungus are echinulate and 19-35 x 3.2-4.5 µm.

We are indebted to Dr. E. Descals (Inst. Estudis Avançats de les Balears, C.S.I.C.) for serving as pre-submission reviewer. We acknowledge the Cuban Ministry of Agriculture for providing facilities.

REFERENCES

- Castañeda Ruiz, R.F. and Kendrick, B. (1991). Ninety-nine conidial fungi from Cuba and three from Canada. *University of Waterloo, Biology Series* **35**: 1-132.
- Hoog, G.S. de (1985). Taxonomy of the *Dactylaria* complex IV-VI. *Studies in Mycology* **26**: 1-122.
- Kirk, P.M. (1983). New or interesting microfungi. XI. Three new hyphomycetes on *Ulex europaeus*. *Transactions of the British Mycological Society* **81**: 401-404.
- Matsushima, T. (1971). *Microfungi of the Solomon Islands and Papua-New Guinea*. Kobe, Matsushima.

COMMENTS ON THE EXSICCAT "LECANOROID LICHENS" III

H.T. LUMBSCH and G.B. FEIGE

Botanisches Institut, Universität Essen, D-45117 Essen, Germany.

Abstract: The third fascicle of the lichen exsiccata "Lecanoroid Lichens" is being issued by the Botanical Institute, University of Essen, Germany. Some comments on the taxonomy, nomenclature and chemistry of the species distributed are recorded. *Lecanora subrugosa* is reduced into synonymy with *L. argentata* and *L. grantii* with *L. xylophila*.

The Botanical Institute at the University of Essen in Germany continues the publication of its series of lichens associated with the Lecanoraceae s. lat., Lecanoroid Lichens, with the distribution of Fascicle III. This fascicle consists of 20 numbers (nos. 41-60). The majority of the specimens distributed were collected in Australia (11), while three specimens come from Austria and Spain and two from the United States. One specimen was collected in Mexico.

Methods

Microscopy. Thalli and apothecia were cut using a freezing microtome in 16-20 μm thickness and stained with lactophenol cottonblue.

Chemistry. The chemical constituents were identified using thin layer chromatography, TLC (Culberson 1972, Culberson et al. 1981, Culberson & Johnson 1982) and gradient-elution high performance liquid chromatography, HPLC (Feige et al. 1993).

Annotated list of the specimens

No. 41: *Haematomma subpunicum* (Müll. Arg.) B. de Lesd.

MEXICO, Chihuahua, Foothills of Sierra El Palomo, Rio San Pedro, small mountain immediately SW of reservoir (presa) in a heavily grazed area with scattered shrubs and small trees, 30°39'N, 108°28'W, ca. 1600 m alt., on siliceous rocks, 16.VII.1994, H. T. Lumbsch & T.H. Nash.

A monograph of the genus *Haematomma* s.str. is in preparation by B. Staiger (Regensburg) and K. Kalb (Neumarkt/Opf.); for further comments we refer to their forthcoming paper. The material distributed contains atranorin, chloroatranorin, psoromic acid and sphaerophorin as major constituents and 2'-*O*-demethylpsoromic acid and unidentified higher homologues of sphaerophorin as minor compounds. Unidentified apothecial pigments are also present. Atranorin and an unidentified apothecial pigment were reported earlier from this species (Culberson 1963).

No. 42: *Lecanora albella* (Pers.) Ach.

AUSTRIA, Salzburg, Pinzgau, Valley of the Kapruner Ache, NE of Kitzsteinhorn, SW of Kesselfall hut, "Naturwaldreservat Kesselfall", maple-ash-forest near a rivulet, 970 m alt. On *Alnus incana*, 15.XI.1993, Th. Rucker & H. Wittmann.

This species is currently better known under the name *L. pallida* (Schreb.) Rabenh. which, however, is a later homonym of *L. pallida* Chevall. as pointed out by Santesson (1993). A proposal to conserve the current use of the epithet *pallida* would most probably be unsuccessful, since the taxonomy of the group is not well settled and both epithets *albella* and *pallida* are widely used in the literature (Santesson, in litt.). Therefore we follow Santesson and use the name *L. albella* as was widely adopted in earlier literature (see Zahlbruckner 1928: 497-500).

The species contains atranorin and protocetraric acid as major compounds and chloroatranorin and conprotocetraric acid as minor substances.

No. 43: *Lecanora argentata* (Ach.) Degelius

AUSTRIA, Steiermark, Steirisches Randgebirge, Grazer Bergland, ca. 25 km NW of Graz, 2.5 km NNW of Geistthal, Almgraben, 700 m. On *Fraxinus excelsior*, 4.IV.1994, H. Wittmann.

Syn.: *Lecanora subrugosa* Nyl., Flora 58: 15 (1875). - *Lecanora rugosa* var. *subrugosa* (Nyl.) Arnold, Flora 67: 326 (1884). - *Lecanora rugosella* var. *subrugosa* (Nyl.) Zahlbr., Cat. Lich. Univ. 5: 525 (1928). - Typus: "Fennia, Tavastia australis, Hollola, Tiirisma, sorbicola", 1873, E. Lang 596 (H-NYL 27600 - Lectotypus).

Lecanora argentata is a morphologically variable species. A morphotype with raised, constricted apothecia and coarsely verrucose to granulose thallus is often distinguished as *L. subrugosa*. Having examined numerous specimens of the cosmopolitan *L. argentata* we are convinced that *L. subrugosa* represents an extreme morphological variant of *L. argentata* caused by the substrate. No anatomical differences could be observed. Poelt & Vezda (1981) have already pointed out that morphological intermediates exist and that typical species occur on *Populus* while the specimens on *Acer* and *Fraxinus* are intermediate. Similar morphological variation caused by the substrate has been observed in the *L. dispersa* group (Poelt, in litt.). In North America, Brodo (1984) found chemical differences between populations of *L. argentata* and *L. subrugosa*. This might indicate that the North American material of *L. subrugosa* belongs to a different taxon.

The specimens distributed contain atranorin and gangaleoidin as major compounds and chloroatranorin, 4-dechlorogangaleoidin and norgangaleoidin as minor constituents.

No. 44: *Lecanora californica* Brodo

USA, California, Sonoma Co., Duncans Point, Duncans Landing Beach, 38°25'N, 123°00'W, ca. 30 m alt. On exposed siliceous rocks in xeric supralittoral zone. Associated lichens included *Lecanora pachysoma*, *Niebla homalea*, *Thelomma mammosum* and *Xanthoria* spp., 2.VIII.1994, H.T. Lumbsch & T.H. Nash.

Lecanora californica was recently described (Brodo 1984) and seems to be restricted to the western coast of North America. The specimen distributed contains atranorin, nephrosteranic acid and norgangaleoidin as major compounds and chloroatranorin, 3'-dechlorolecideoidin and didechlorolecideoidin as minor constituents.

No. 45: *Lecanora elapheia* Stizenb.

AUSTRALIA, South Australia, Eyre Peninsula, Eyre Hwy, 35 km W of Wudinna, mallee eucalypts with understorey of *Melaleuca*, *Acacia*, *Halgonia*, *Eremophila* and *Triodia*, 32°52'S, 135°10'E, ca. 250 m. On *Melaleuca* twigs, 6.IX.1994, E. & H.T. Lumbsch & J. Curnow.

A description and discussion of this species has been published by Lumbsch (1994). The species concept in the *L. sienae* group remains dubious. Lumbsch (loc. cit.) has synonymized the Mediterranean *L. oleae* Reichert & Galun and

L. palestinica Räsänen with *L. elapheia*, and mentioned that the distinction of *L. elapheia* from *L. laevis* and *L. sienae* remains to be restudied. Since we lack experience with this group in the Mediterranean, we would like to draw the attention of our Southern European colleagues to this problematic group.

Lecanora elapheia contains atranorin and the unknown triterpenoid Lgr-1 as major substances and chloroatranorin and the unknown triterpenoids Lgr-2 and Lcm-1 as minor substances, as well as traces of further unidentified terpenes.

No. 46: *Lecanora epibryon* ssp. *broccha* (Nyl.) Lumbsch

AUSTRALIA, Victoria, Bogong High Plains, "Ruined Castle", 16.5 km SSE of Mt Beauty, 36°52'S, 147°15'E, 1620 m. On soil and plant debris in alpine grassland, 18.II.1994, J.A. Elix & H. Streimann.

The chemical variation in *L. epibryon* was discussed at length by Lumbsch et al. (1994). The material distributed exhibited the following chemistry. Major substances: atranorin, stictic acid and 2,5,7-trichloro-3-*O*-methylnorliche-xanthone; minor substances: chloroatranorin, constictic acid, cryptostictic acid, menegazziaic acid, norstictic acid and 5,7-dichloro-3-*O*-methylnorliche-xanthone.

No. 47: *Lecanora farinacea* Fée

AUSTRALIA, Victoria, Western District, Pomorneit East Road, dry sclerophyll forest with basaltic outcrops, 38°40'S, 143°60'E. On exposed basalt. Associated lichens included *Parapropidia leptocarpa*, *Pertusaria lophocarpa*, *Tephromela atra* and *Xanthoparmelia* spp., 28.VII.1991, H.T. Lumbsch & W.H. Ewers.

This species is widely distributed in the Southern Hemisphere. A full description is given by Imshaug & Brodo (1966) and Dickhäuser et al. (1995). The material distributed contains atranorin and protocetraric acids as major compounds and chloroatranorin, connorstictic and norstictic acids as minor substances.

No. 48: *Lecanora leptacinella* Nyl.

AUSTRIA, Salzburg, Hohe Tauern, Kapruner Tal, Dreiwallner-Höhe S of Maißkogel above Kaprun, 1850 m. On mosses, 15.VI.1976, K. Kalb & G. Plöbst.

A full description and discussion of this species was published by Obermayer & Poelt (1994).

No. 49: *Lecanora lisbonensis* Sampaio

SPAIN, Baleares, Menorca, Punta Prima, coastal shrubs on limestone on the way to Alcaufar, 39°48'N, 4°15'E, 0-10 m alt. On limestone, 19.V.1994, H.T. Lumbsch, S. Paus & G.B. Feige.

No. 50: *Lecanora margarodes* (Koerber) Nyl.

AUSTRALIA, Queensland, Bunya Mts National Park, track from Wescott Plain Camping Ground to Koondaii Lookout, wet sclerophyll forest, 26°52'S, 151°34'E, ca. 1000 m, on siliceous rocks, 21.X.1994, H.T. Lumbsch & A. Dickhäuser.

A description of this species can be found in Lumbsch (1994). The following phenolic substances occur in *L. margarodes*. Major substances: atranorin, pannarin, arthothelin and isoarthothelin; minor constituents: 7-chloronorlichexanthone, 2,4-dichloronorlichexanthone, 2,7-dichloronorlichexanthone, 4,5-dichloronorlichexanthone, 5,7-dichloronorlichexanthone, thiophanic acid and chloroatranorin.

No. 51: *Lecanora mayrhoferi* Lumbsch - Topotypus

AUSTRALIA, Western Australia, Stirling Ranges, Stirling National Park, Bluff Knoll, 34 km S of Borden, 34°23'S, 118°15'E, ca. 1200 m. On siliceous rocks, 17.IX.1994, E. & H.T. Lumbsch.

Lecanora mayrhoferi was described in Lumbsch et al. (1994a). A full description and discussion of its relationships can be found there. The material distributed in our exsiccate was collected at the same locality as the type. We could even observe some traces made by the original collector. The lichen contains atranorin, asemone, isoarthothelin, 5,7-dichloro-3-*O*-methylnorlichexanthone and 2,5,7-trichloro-3-*O*-methylnorlichexanthone as major compounds; the minor substances present are: arthothelin, chloroatranorin, 5,7-dichloronorlichexanthone, 3-*O*-methylassemone and 2,5,7-trichlorolichexanthone.

No. 52: *Lecanora praepostera* Nyl.

SPAIN, Baleares, Menorca, Sa Roca de S'Indio, between Es Mercadal and Ferreries, sandstone boulders in Quercetum ilicis, 39°58'N, 4°03'E, 100-150 m, on overhanging siliceous rocks, 21.V.1994, G.B. Feige, H.T. Lumbsch & S. Paus.

This species is often called *L. schistina* (Nyl.) Arnold. Although the name *schistina* was described earlier than *praepostera*, it was originally described at the forma rank and is a later synonym of *praepostera* at the species level. The typification was discussed by Lumbsch (1994).

Lecanora praepostera is common on siliceous rocks in Western Europe, the Mediterranean and Macaronesia. This collection contains atranorin, chloroatranorin and norstictic acid as major substances and connorstictic and stictic acids as minor compounds.

No. 53: *Lecanora pseudogangaleoides* Lumbsch

AUSTRALIA, Australian Capital Territory, Molonglo Gorge, 13 km ESE of

Canberra, dry sclerophyll forest on very rocky slopes, 35°20'S, 149°16'E, 570 m. On shaded siliceous rocks, 13.VIII.1991, H.T. Lumbsch & J. Curnow.

This species was described and its relationships discussed by Lumbsch (1995). The species contains psoromic and usnic acids and atranorin as major substances and chloroatranorin and 2'-*O*-demethylpsoromic acid as minor substances.

No. 54: *Lecanora queenslandica* Knight

AUSTRALIA, Queensland, Bunya Mts National Park, track from Cherry Plain Picnic Area to lookout, wet sclerophyll forest, 26°51'S, 151°34'E, ca. 1000 m. On bark, 20.X.1994, H.T. Lumbsch & A. Dickhäuser.

A description of *L. queenslandica* is given by Lumbsch et al. (1995). The species contains psoromic and usnic acids as major substances and atranorin, chloroatranorin, 2'-*O*-demethylpsoromic acid and unidentified triterpenoids as minor substances.

No. 55: *Lecanora wilsonii* Müll. Arg.

AUSTRALIA, New South Wales, Myall River State Forest, Booral - Bulahdelah road, rocky outcrops in pasture land, ca. 12 km SW of Bulahdelah, 32°28'S, 152°07'E, ca. 90 m alt. On siliceous rocks. Associated lichens included *Buellia* spp., *Lecanora farinacea*, *L. plumosa*, *Pannaria crustata* and *Porpidia crustulata*, 20.VI.1991, H.T. Lumbsch, A.W. Archer and R.B. Filson.

This species was described and discussed by Lumbsch et al. (1995). It contains usnic acid as major constituent and the following minor substances: atranorin, chloroatranorin and two unknown fatty acids.

No. 56: *Lecanora xylophila* Hue

USA, Washington, Skagit Co., Whidbey Island, Deception Pass State Park, West Beach, 0 m alt. On driftwood, 13.VIII.1994, H.T. Lumbsch & T.H. Nash.

Syn.: *Lecanora grantii* H. Magn., Ann. Crypt. Exot. **5**: 21 (1932). - Typus: USA, Washington, Marysville, "on log on sea beach", 1926, *Grant* (UPS-Holotypus).

In 1984 Brodo already pointed out that *L. grantii* and *L. xylophila* are very similar and might be conspecific, but according to Miyawaki (1988) the two species differ in the thickness of the thallus. Lumbsch (1994) followed the latter opinion and mentioned that New Zealand collections were consistent with the North American material in having a thin thallus and large apothecia. On a field trip guided by Professor Nash (Tempe) the first author was able to study this species in the field and observe the morphological plasticity of this taxon. The material distributed also shows great variability of thallus thickness and

apothecial size, consistent with the proposed synonymy of *L. grantii* with *L. xylophila*. This material contains the following secondary compounds. Major substances: atranorin and the unknown triterpenoid Lgr-1; minor substances: chloroatranorin and the unknown triterpenoid Lgr-2.

No. 57: *Protoparmelia montagnei* (Fr.) Poelt & Nimis

SPAIN, Balears, Menorca, N coast, Binimel-la, coastal shrubs on sandstone, 40°03'N, 4°03'E, 50 m. On siliceous rocks, 22.V.1994, G.B. Feige, H.T. Lumbsch & S. Paus.

This submediterranean-atlantic lichen is related to *P. badia* from which it can be distinguished by the oblong-ellipsoid spores. According to Purvis et al. (1992) three chemotypes occur within *P. montagnei*. The material distributed belongs to chemotype 1 and contains lobaric acid as major constituent and gyrophoric acid and norlobaridone as minor substances.

No. 58: *Pyrrhospora laeta* (Sirton) Hafellner

AUSTRALIA, Victoria, Mt Cole State Forest, Ben Nevis, hang-gliding area, 24 km ENE of Ararat, dry sclerophyll forest with large boulders, 37°14'S, 143°12'E, 700 m, on *Acacia*, 5.X.1994, H.T. Lumbsch, A. Dickhäuser & H. Streimann.

No. 59: *Ramalinora glaucolivida* (Müll.Arg.) Lumbsch, Rambold & Elix

AUSTRALIA, Queensland, on side of road from Pechey to Perseverance Creek Dam, 1.5 km NE of Toowoomba to Crows Nest road, 27°18'S, 152°04'E, ca. 550 m. On soil, 21.X.1994, H.T. Lumbsch & A. Dickhäuser.

The genus *Ramalinora* was described by Lumbsch et al. (1995a) for the enigmatic *Lecanora glaucolivida*. Although it has a crustose thallus, the chemistry, ascus structure and ascomatal development indicate that it is best placed in the Ramalinaceae. The specimens distributed belong to chemotype II with boninic, 2-*O*-methylsekikaic and usnic acids.

No. 60: *Ramboldia stuartii* (Hampe) Kantvilas & Elix

AUSTRALIA, South Australia, High Eden Road, 6 km NW of Springton, heathy dry sclerophyll forest on moderate slope, 34°41'S, 139°02'E, ca. 400 m. On dead *Eucalyptus* wood, 24.IX.1994, H.T. Lumbsch, A. Dickhäuser, J.A. Elix & H. Streimann.

The genus *Ramboldia* was recently segregated from *Pyrrhospora*, primarily differing in the absence of anthraquinone pigments in the apothecia (Kantvilas & Elix 1994). The delimitation of the genera *Protoparmelia*, *Pyrrhospora* and *Ramboldia* remains to be evaluated. The former two genera seem to be heterogeneous.

We wish to thank the curators of the herbaria cited and the private collectors for sending us specimens in their care for examination. The assistance of all those who helped with the collection of the specimens, organizing excursions or sent material for distribution, especially Dr. A.W. Archer, Mrs. J. Curnow, Mr. A. Dickhäuser, Prof. Dr. J.A. Elix, Mr. W.H. Ewers, Dr. R.B. Filson, Dr. K. Kalb, Dr. E. Lumbsch, Prof. Dr. T.H. Nash, Dr. W. Obermayer, Mrs. S. Paus, Mrs. G. Plöbst, Mr. Th. Rücker, Mr. H. Streimann, Dr. H. Wittmann is gratefully acknowledged. Prof. Dr. J. Poelt and Prof. Dr. R. Santesson are thanked for helpful comments. We thank Mr. R. Kricke for technical assistance and Prof. Dr. J.A. Elix for his comments on the manuscript. Prof. Dr. T.L. Esslinger kindly reviewed our manuscript.

References

- Brodo, I.M. (1984) The North American species of the *Lecanora subfusca* group. *Beih. Nova Hedwigia* **79**: 63-185.
- Culberson, C.F. (1972) Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromatogr.* **72**: 113-125.
- Culberson, C.F. & A. Johnson (1982) Substitution of methyl *tert*.-butyl ether for diethyl ether in standardized thin-layer chromatographic method for lichen products. *J. Chromatogr.* **238**: 438-487.
- Culberson, C.F., W.L. Culberson & A. Johnson (1981) A standardized TLC analysis of β -orcinol depsidones. *Bryologist* **84**: 16-29.
- Culberson, W.L. (1963) A summary of the lichen genus *Haematomma* in North America. *Bryologist* **66**: 224-236.
- Dickhäuser, A., H.T. Lumbsch & G.B. Feige (1995) A synopsis of the *Lecanora subcarnea* group. *Mycotaxon* in press.
- Feige, G.B., H.T. Lumbsch, S. Huneck & J.A. Elix (1993) The identification of lichen products by a standardized high-performance liquid chromatographic method. *J. Chromatogr.* **646**: 417-427.
- Imshaug, H.A. & I.M. Brodo (1966) Biosystematic studies on *Lecanora pallida* and some related lichens in the Americas. *Nova Hedwigia* **12**: 1-59.
- Kantvilas, G. & J.A. Elix (1994) *Ramboldia*, a new genus in the lichen family Lecanoraceae. *Bryologist* **97**: 296-304.
- Lumbsch, H.T. (1994) Die *Lecanora subfusca*-Gruppe in Australasien. *Journ. Hattori Bot. Lab* **77**: 1-175.
- Lumbsch, H.T. (1995) A new species in the *Lecanora subfusca* group containing usnic acid in addition to atranorin. *Lichenologist* **27**: in press.
- Lumbsch, H.T., G.B. Feige & J.A. Elix (1994) Chemical variation in two species of the *Lecanora subfusca* group (Lecanoraceae, lichenized Ascomycotina). *Pl. Syst. Evol.* **191**: 227-236.
- Lumbsch, H.T., G.B. Feige & J.A. Elix (1994a) The joint occurrence of chloroxanthones in Southern Hemisphere *Lecanora* species (Ascomycotina; Lecanoraceae). *Bot. Acta* **107**: 30-35.
- Lumbsch, H.T., G.B. Feige & J.A. Elix (1995) A revision of the usnic acid containing taxa belonging to *Lecanora sensu stricto* (Lecanorales; lichenized Ascomycotina). *Bryologist* in press.

- Lumbsch, H.T., G. Rambold & J.A. Elix (1995a) *Ramalinora* - a new lichen genus from Australia. *Aust. Syst. Bot.* **8**: in press.
- Miyawaki, H. (1988) Studies on the *Lecanora subfusca* group in Japan. *Journ. Hattori Bot. Lab.* **64**: 271-326.
- Obermayer, W. & J. Poelt (1994) *Lecanora leptacinella*, *Lecidea polytrichina* und *Lecidea polytrichinella* spec. nova, drei acidophile Moose gebundene Flechten von arktisch(-alpiner) Verbreitung. *Acta Bot. Fenn.* **150**: 131-142.
- Poelt, J. & A. Vezda (1981) Bestimmungsschlüssel europäischer Flechten. *Ergänzungsheft II. Bibl. Lichenol.* **16**: 1-390.
- Purvis, O.W., B.J. Coppins, D.L. Hawksworth, P.W. James & D.M. Moore (1992) *The lichen flora of Great Britain and Ireland*. London.
- Santesson, R. (1993) *The lichens and lichenicolous fungi of Sweden and Norway*. Lund.
- Zahlbruckner, A. (1928) *Catalogus Lichenum Universalis*. Band 5. Leipzig.

THE LICHEN GENUS *DIPLOSCHISTES* IN SOUTH AFRICA (THELOTREMATACEAE)

ROLAND GUDERLEY and H. THORSTEN LUMBSCH

Botanisches Institut, Universität Essen, D-45117 Essen, Germany

Abstract: The *Diploschistes* taxa occurring in Southern Africa are revised. Descriptions of selected species and a key to the 14 taxa accepted are included. *D. hensseniae* and *D. hypoleucus* are recorded for the first time from South Africa. *D. chloroleucus*, *D. compositus*, *D. lutescens*, *D. ocellatus* f. *isabellinus*, *D. subfarinaceus* and *Urceolaria bispورا* var. *terricola* are reduced to synonymy with *D. cinereocaesius*, and *D. almbornii* with *D. diploschistoides*. *D. austroafricanus* Guderley & Lumbsch is described as new.

The present study is a further contribution to the knowledge of the genus *Diploschistes* and it is mainly based on a "Staatsexamensarbeit" by the first author (Guderley 1995). The Holarctic taxa were monographed by Lumbsch (1989) and other investigations on *Diploschistes* species have been reported in various papers (Abu-zinada et al. 1986, Lumbsch 1987, 1993, Lumbsch & Aptroot 1993, Lumbsch & Elix 1985, 1989, Lumbsch & Mayrhofer 1990). A key to the non-European species was provided by Magnusson (1956) and more recently, Pant & Upreti (1993) revised the genus on the Indian subcontinent. The aim of the present publication was to revise the South African representatives of the genus and to provide a key to the taxa. A complete account of the morphology, anatomy and chemistry is not included here, but can be found in Lumbsch (1989). Descriptions are not given for species described in one of our publications cited above. During our studies we have found that *D. bisporus* differed in excipulum structure and will be segregated as a distinct genus in a forthcoming publication.

Material and Methods

Material. Specimens were studied from the following herbaria: BM, BOL, ESS, GZU, H, L, LD, M, PC, S, STEU, STU, TRH, TUR, UPS, UPSV, US, W and the private herbaria of J. Hafellner (Graz), K. Kalb (Neumarkt) and H.T. Lumbsch (Essen).

Methods. Microscopy. Thalli and apothecia were cut using a freezing microtome in 16-20 μm thickness and stained with lactophenol cottonblue.

Chemistry. The chemical constituents were identified using thin layer chromatography, TLC (Culberson 1972, Culberson & Johnson 1982) and gradient-elution high performance liquid chromatography, HPLC (Feige et al. 1993).

Key to the South African taxa

- | | | |
|--------|--|---|
| 1 | Ascomata perithecioid | 2 |
| | Ascomata apothecioid | 8 |
| 2(1) | Thallus pruinose, whitish, terricolous, spores 16-24 x 6-11 μm | <i>D. hensseniae</i> |
| | Thallus not whitish, epruinose, saxicolous | 3 |
| 3(2) | Thallus C ⁻ , spores nearly roundish, 19-37 x 11-24 μm | <i>D. euganeus</i> |
| | Thallus C ⁺ red, spores narrower | 4 |
| 4(3) | Thallus brownish | 5 |
| | Thallus grey to bluish grey | 7 |
| 5(4) | Gyrophoric acid as major substance | <i>D. sticticus</i> |
| | Lecanoric acid as major substance | 6 |
| 6(5) | Thallus dark brown, spores 16-26 x 8-18 μm | <i>D. aeneus</i> |
| | Thallus yellowish brown, spores 34-40 x 19-22 μm | <i>D. austroafricanus</i> |
| 7(4) | Thallus bluish grey, spores 30-52 x 15-26 μm | <i>D. diploschistoides</i> |
| | Thallus light grey, spores 16-32 x 10-20 μm | <i>D. actinostomus</i> |
| 8(1) | Thallus PD ⁺ red, C ⁻ , whitish, areoles bullate | <i>D. ocellatus</i> |
| | Thallus PD ⁻ | 9 |
| 9(8) | Terricolous | 10 |
| | Saxicolous | 14 |
| 10(9) | Major compound gyrophoric acid, spores broadly ellipsoid | <i>D. hypoleucus</i> |
| | Gyrophoric acid lacking | 13 |
| 11(10) | Thallus whitish, pruinose | 14 |
| | Thallus brownish to yellowish, epruinose | 15 |
| 12(11) | Juvenile parasite on <i>Cladonia</i> spp., thallus rather thin | <i>D. muscorum</i> ssp. <i>bartlettii</i> |
| | Not lichenicolous, thallus rather thick | <i>D. thunbergianus</i> |

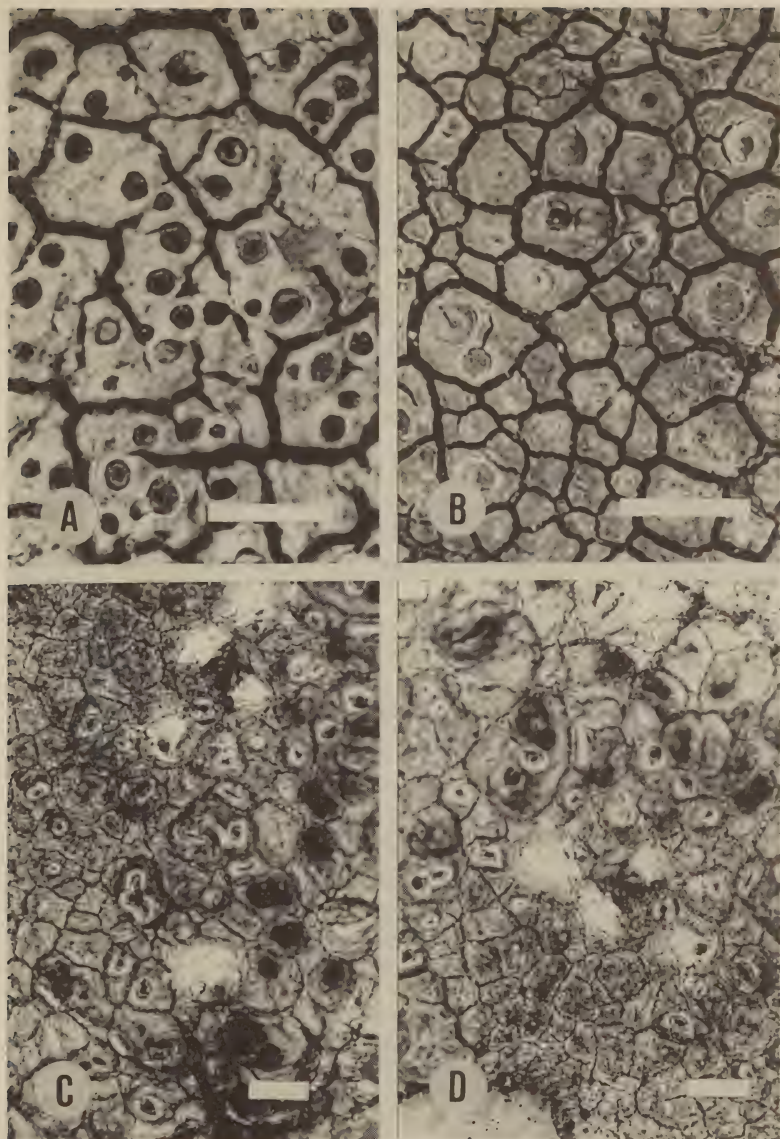


Fig. 1. South African species of *Diploschistes* l. - A. *D. actinostomus*. B. *D. aeneus*. C & D. *D. austroafricanus*. Scale = 1 mm.

- | | | |
|--------|---|--------------------------|
| 13(12) | Apothecia small, up to 1 mm in diam. | <i>D. isabellinus</i> |
| | Apothecia larger, up to 3.6 mm in diam. | <i>D. cinereocaesius</i> |
| 14(9) | Thallus greyish, spores 25-40 x 10-20 μm | <i>D. scruposus</i> |
| | Thallus yellowish to yellowish brown, spores 18-27 x 9-15 μm | <i>D. cinereocaesius</i> |

The South African Taxa

1. *Diploschistes actinostomus* (Pers. ex Ach.) Zahlbr.

Hedwigia 31: 34 (1892). - *Verrucaria actinostoma* Pers. ex Ach., Lich. Univ.: 288 (1810); a complete description of this species is given by Lumbsch (1989).

(Fig. 1 A)

Chemistry: major substances: lecanoric and diploschistesic acids; minor compounds: orsellinic and $\pm$ gyrophoric acid.

Both morphologically and chemically *D. actinostomus* is very similar to *D. caesioplumbeus* and *D. diploschistoides*. Generally the latter two species have a darker thallus than *D. actinostomus*, but overlaps do occur and to determine a specimen with certainty, spore measurements are necessary. The spores in *D. caesioplumbeus* and *D. diploschistoides* are significantly larger. *D. caesioplumbeus* does not occur in South Africa. A further character to separate *D. diploschistoides* is the strongly amyloid and halonate ascospores.

Ecology and distribution: *D. actinostomus* occurs on exposed siliceous rocks, usually in maritime or humid places. It has a cosmopolitan distribution. In South Africa it is widely distributed (Fig. 2) and is the most common species of the genus.

Selected specimens examined: **South Africa.** CAPE PROVINCE. DISTR. CALEDON, Mossel River, *O. Almborn* 5697 (LD) - DISTR. CAMPS BAY, *D. Triebel & G. Rambold* 8615 (M). - DISTR. CAPE, Hottentots Huise, *O. Almborn* 934, 961 (LD). - DIV. OF CLANWILLIAM, Pakhuispas, *O. Almborn & I. Kärnefelt* 8413-6, 84915, 84916 (LD). - DISTR. GEORGE, 7 mi E of George, *O. Almborn* 2378 (LD) - DISTR. EAST LONDON, 2 mi E of Potsdam, *O. Almborn* 10686 (LD). - DISTR. MALMESBURY, Saldanha, *O. Almborn* 5024 (LD). - DIV. NAMAQUALAND, Kamieskroon, *Almborn & I. Kärnefelt* 8419-24 (LD). - DISTR. SIMONSTOWN, near Cape of Good Hope, *O. Almborn* 11467 (LD). - DISTR. TARKA, 10 km S of Tarkastad, *I. Kärnefelt* 8635-7 (LD). - DISTR. VANRHYNSDORP, 2 mi N of Nieuwe Rust, *O. Almborn* 4931 (LD). - DIV. OF WORCESTER, Wellington, *O. Almborn & I. Kärnefelt* 8426-1 (LD). - KAPLAND, Poolesbaai, v.d. Byl 12469, 12487, 12668 (STEU). - Hermanus, v.d. Byl 7295 (STEU). - NATAL. DIV. BERGVILLE, Cathedral Peak area, *L. Kofler* 2114 (LD). - Indumeni Forest, *O. Almborn* 9335 (LD). - Organ Pipes, *O. Almborn* 9070 (LD) -

ESTCOURT DISTR., Gaint's Castle Game Reserve, *I. Kärnefelt* 8628-75, 8628-53 (LD). - Drakensberge, Van Reenen-Pass, *I. Brunnthaler* 8394 (LD). - DISTR. PIETERMARITZBURG, Natal Tablemountain, *O. Almborn* 8605 (LD). - ANDERBERG DISTR., Sané Pass, *I. Kärnefelt* 8629-9 (LD). - ORANGE FREE STATE. Golden Gate Highlands National Park, *D. Triebel & G. Rambold* 6745 (M). - SWAZILAND. DISTR. MBABANE, 15 mi SW of Piggs Peak, *O. Almborn* 7951 (LD). - DISTR. PEAK, 7 mi E of Havelook, *O. Almborn* 7868, 7873 (LD). - TRANSVAAL. DISTR. LYDENBURG, 5 mi E of Mokobulaan, *O. Almborn* 7455 (LD). - DISTR. PILGRIMS REST, 4 mi SE of Pilgrims Rest, *O. Almborn* 7833 (LD). - DISTR. ZOUTPANSBERG, Wyllie's Poort, *Almborn* 6418 (LD).



Fig. 2. Distribution of *D. actinostomus* (★) in South Africa and worldwide distribution of *D. austroafricanus* (●).

2. *Diploschistes aeneus* (Müll. Arg.) Lumbsch

Journ. Hattori Bot. Lab. **66**: 158 (1989). - *Urceolaria actinostoma* var. *aenea* Müll. Arg., Rev. Mycol. **38**: 12 (1888). - *Diploschistes actinostomus* var. *aeneus* (Müll. Arg.) Steiner, Sitzungsber. K. Akad. Wiss. Wien, math. nat. Cl. **106**: 227 (1897); a complete description of this species is given in Lumbsch (1989).

(Fig. 1 B)

Chemistry: major substance: lecanoric acid; minor substances: orsellinic and diploschistesic acids.

D. aeneus is characterized by its brown to bronze thallus colour, the relatively small ascospores and the presence of lecanoric acid as the major compound. Morphologically *D. aeneus* is similar to *D. austroafricanus*, a discussion of which is found below. *D. badius*, described from North America (Lumbsch &

Elix 1989) is also similar, but can be readily distinguished by the presence of gyrophoric acid as major constituent.

Ecology and distribution: *D. aeneus* occurs on exposed siliceous rocks mainly in semiarid regions. Lumbsch (1989) originally proposed that *D. aeneus* had an Asian North American disjunct distribution, but this species has since been recorded from Southern Europe (Lumbsch et al 1993) and now in South Africa. The presence of *D. aeneus* in the Cape region was formerly recorded by Stizenberger (1890 as *Urceolaria actinostoma* var. *aenea*) and this previously overlooked record is now confirmed by our studies. In South Africa the species is mainly distributed in winter rain areas of the Cape Province, but was also collected in Namaqualand (Fig. 3).

Selected specimens examined: **South Africa.** CAPE PROVINCE. - DISTR. CAPE, Camps Bay, *O. Almborn* 4464 (LD). - DISTR. CLANWILLIAM, 1 km SSE of Clanwilliam Dam Ressort, 1987, W. & U. Wetschnig (GZU). - DISTR. MIDDELBURG, Lootsberg Pass, *I. Kärnefelt* 8640-49 (LD). - DISTR. NAMAQUALAND, 1 mi N of Kamieskroon, *O. Almborn* 4841 (LD). - DISTR. PAARL, Paarl Rock, *O. Almborn* 5518 (LD). - DISTR. VAN RHYNSDORP, Van Rhyns Pass, *O. Almborn* 4644 (LD).

3. *Diploschistes austroafricanus* Guderley & Lumbsch spec. nov.

(Fig. 1 C & D)

Planta saxicola. Thallus crustaceus, uniformis, adnatus, rimoso areolatus vel verrucosus, opacus usque ad lucidus, luteofuscus, epruinosis. Areolae 0.3 - 1 mm latae, irregulariter angulosae, planae usque ad verrucosae. Alga ad genus *Trebouxia* pertinet. Apothecia immersa, fusca, usque ad 2.5 mm in diametro et usque ad 1.4 mm alta. Excipulum proprium fuscum, 60 - 90 μ m crassum, pseudoparenchymaticum. Hymenium 100 - 160 μ m altum. Hypothecium 10 - 15 μ m altum, hyalinum. Paraphyses 1 - 1.5 μ m crassae, simplices, laxae. Asci cylindrici usque ad subclavati, 90 - 140 x 20 - 40 μ m, 6 - 8 spori. Ascospores ellipsoidae, brunneae, murali-divisae, 6 - 7 septis transversalibus, 2 - 3 longitudinalibus, 34 - 40 x 19 - 22 μ m. Thallus acidum lecaniorum continens.

Type: **South Africa.** CAPE PROVINCE. NAMAQUALAND. Knersvlakte, ca. 25 km N of Vanrhynsdorp, near "Douse the Glim", on quartzitic rocks, 31°23' S, 18°42' E, 150 m, 2.X.1987, W. & U. Wetschnig (GZU-holotype).

Thallus crustose, rimose areolate to verruculose, opaque to shining, yellowish brown, epruinose. Areoles 0.3 to 1 mm in diameter, plane to verrucose. Algae belonging to the genus *Trebouxia*.

Apothecia immersed, perithecioid, grey to blackish, up to 1.4 mm high, up to 0.6 mm in diameter when viewed from above, up to 2.5 mm wide in section.

Excipulum proprium blackish, 60 - 90 μm thick, pseudoparenchymatous. Hymenium 100 - 160 μm high. Hypothecium 10 - 15 μm high, hyaline. Paraphyses 1.0 - 1.5 μm thick, simple and lax. Asci cylindrical to subclavate, 90 - 140 x 20 - 40 μm , 6 - 8 spored. Ascospores brown, muriform, ellipsoid, 6 - 7 transverse septa, 2 - 3 longitudinal septa, 34 - 40 x 19 - 22 μm .



Fig. 3. Distribution of *D. aeneus* in South Africa.

Chemistry: major substance: lecanoric acid, minor substances: diploschistesic and orsellinic acids.

The new species is characterized by the brown thallus, the relatively large ascospores and the presence of lecanoric acid as the major compound. Morphologically it is similar to *D. aeneus*, but is readily distinguished by the lighter thallus colour and the larger ascospores. *D. euganeus* is another similar species, but lacks secondary metabolites, has a thinner thallus and smaller spores.

Ecology and distribution: The new species grows on siliceous rocks in the western part of South Africa in Namaqualand (Fig. 2) and is only known from the type locality.

4. *Diploschistes cinereocaesius* (Sw. ex Ach.) Vainio

Ann. Acad. Sci. Fen., ser. A, **15** (6): 172 (1921). - *Lichen cinereocaesius* Sw. ex Ach., Lichenogr. Suec. Prodr.: 34 (1798). Type: "Sw." (UPS-ACH - lectotype, here selected; H-ACH 1083 - isolectotype).

(Fig. 4 A)

- Syn. nov.: *Diploschistes chloroleucus* (Tuck.) Zahlbr., Hedwigia **31**: 34 (1892). - *Urceolaria chloroleuca* Tuck., Proc. Amer. Acad. Arts & Sci. **6**: 268 (1864). Type: Cuba, Wright Lich. Cub. 123 (L - lectotype, here selected).
- Diploschistes compositus* Dodge, Beih. Nova Hedwigia **12**: 107 (1964). Type: Ethiopia, 25.7.1957, C.B.E.E. 32 (BM - holotype).
- Diploschistes lutescens* Zahlbr., Ann. Mycol. **10**: 373 (1912). Type: Hawaii, Mt. Mauna Kea, 3000 ft., Faurie 815 (PC - holotype).
- Diploschistes ocellatus* f. *isabellinus* Zahlbr., Hedwigia **74**: 198 (1935). Type: China, Mountains between the Litang and Yalung rivers, between Muli Gomba and Bonrong and Wa-Erh-Dje, 4250 m, F. Rock 16720 (W - holotype).
- Diploschistes subfarinaceus* H. Magn., Ark. Bot. ser. 2, **3** (10): 286 (1955). Type: Hawaii, Mauna Kea at 2000 m, 1909, Faurie 847 (PC - lectotype, BM, S - isotypes).
- Urceolaria bispora* var. ("b") *terricola* Krempelh., Bolet. Acad. Nac. Cienc. Rep. Arg. **3**: 119 (1879). Type: Argentina, 1872-74, Lorentz & Hieronymus (M - holotype).

Thallus crustose, uniform, adnate, continuose to rimose areolate or verrucose, opaque, yellowish grey to whitish, epruinose. Areoles 0.3 - 1 mm in diam., verrucose. Algae belonging to the genus *Trebouxia*.

Apothecia sessile, apothecioid, disc blackish, epruinose or bluish pruinose, up to 3.6 mm in diam., often composed. Excipulum proprium blackish, up to 140 μm thick, pseudoparenchymatous. Hymenium 90 - 120 μm high. Hypothecium 14 - 18 μm high, hyaline. Paraphyses 1 - 1.5 μm thick, simple and lax. Asci cylindrical, 80 - 100 x 15 - 40 μm , 4 - 8 spored. Ascospores hyaline to brown, muriform, ellipsoid, 3 - 5 transverse septa, 1 - 2 longitudinal septa, 18 - 31 x 9 - 15 μm , I-.

Chemistry: major substance: lecanoric acid; minor substances: diploschistesic and orsellinic acids.

D. cinereocaesius is easily recognized by its yellowish to yellowish brown thallus and the relatively large, often composite apothecia. *D. isabellinus* and *D. muscorum* ssp. *bartlettii* can be distinguished by their smaller fruiting bodies.

The distinction of *D. cinereocaesius* from *D. rampoddensis* was discussed by Lumbsch (1993), but this problem needs to be reexamined, in particular with collections from tropical areas. In South Africa all saxicolous specimens could be identified as *D. cinereocaesius*.

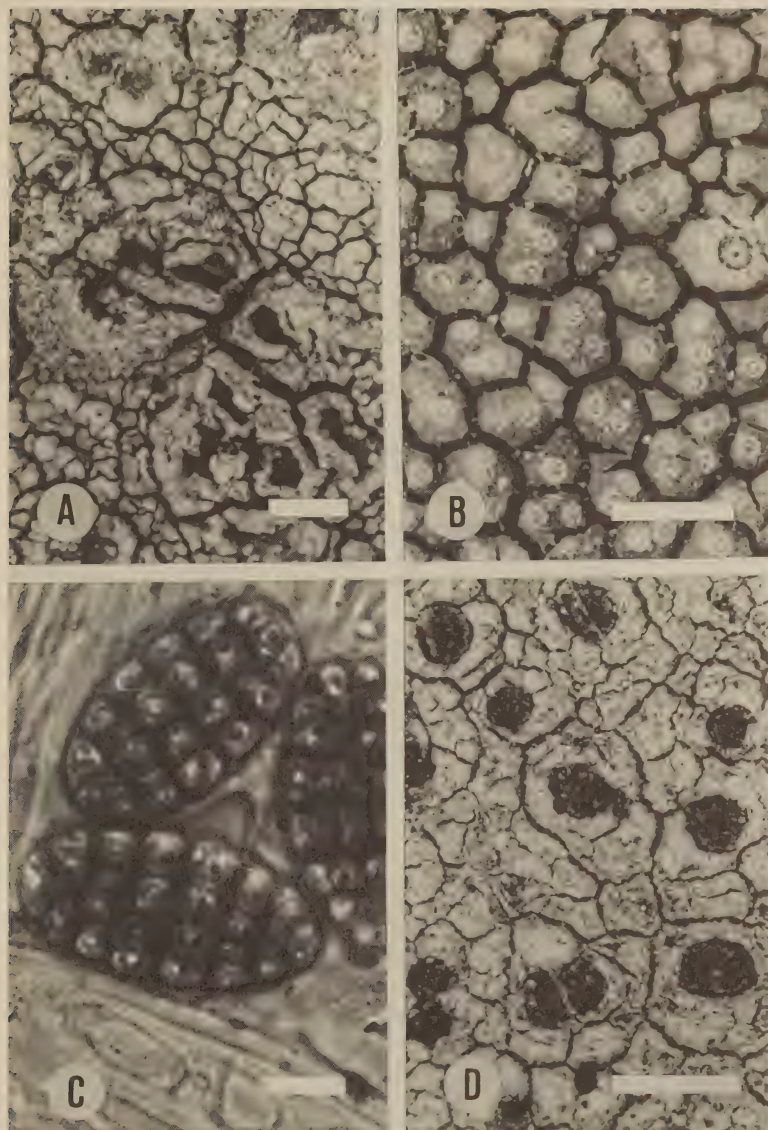


Fig. 4. South African species of *Diploschistes* II. - A. *D. cinereocaesius*. B. & C. *D. diploschistoides*, C. ascospores. D. *D. euganeus*. Scale = 1 mm.

Ecology and distribution: *D. cinereocaesius* is a pantropical lichen which occurs in open habitats at higher altitudes in Central and South America, Africa, Southeast Asia, India and New Guinea. It grows on siliceous soil and rocks. In South Africa this species occurs in subtropical parts of the country (Fig. 5).



Fig. 5. Distribution of *D. cinereocaesius* in South Africa.

Selected specimens examined: **South Africa.** CAPE PROVINCE. DIV. OF CLANWILLIAM, Pakhuispas, *O. Almborn* & *I. Kärnefelt* 8413-7, 8413-9 (LD). - DIV. VICTORIA EAST, Hogsback, *L. Kofler* (LD). - NATAL. DISTR. ALFRED, Impetyne Forest, *O. Almborn* 10201 (LD). - DISTR. BERGVILLE, Cathedral Peak area, *O. Almborn* 8818 (LD), *I. Kärnefelt* 8627-3, 8627-1 (LD). - DIV. PEAK, Pigg's Peak, 20.VII.1962, *L. Kofler* (LD). - DISTR. PIETERMARITZBURG, Table Mt., *O. Almborn* 8634 (LD). - DISTR. POHLA, Mgatschein Valley, 9.X.1929, *O.A. Höeg* (TRH). - ORANGE FREE STATE, 5 mi W of Ladybrand, *R.A. Maas Geesteranus* 6517 (L) - Golden Gate National Park, *M.E. Hale* 74930 (US). - NYANZA PROV. DISTR. OF KISUMA-LENDIANI, Tindeset Forest Reserve, *R.A. Geesteranus* 5085 (L). - TRANSKEI. DISTR. MOUNT FLETCHER, Lusi Poort, *I. Kärnefelt* 8631-15 (LD). - TRANSVAAL. DISTR. LYDENBURG, 5 mi N of Mokobulaan, *O. Almborn* 7799 (LD). - Houtbosdorp, *O. Almborn* & *I. Kärnefelt* 8470 (LD). - DISTR. PRETORIA, Water Kloof, *R.A. Maas Geesteranus* 6401 (L). - DISTR. TZANEEN, Magoebaskloof, *I. Kärnefelt* 8611-2 (LD). - LESOTHO. DIV. LERIBE, Buthabuthe, 23.III.1963, *L. Kofler* (LD). - DIV. MASERU, Roma Valley, 4.IV.1962, *L. Kofler* (LD). - DIV. QUACHAS NEK, 13.XI.1963, *L. Kofler* (LD). - DIV. QUTHING, Villa Maria near Quthing, 22.IX.1962, *L. Kofler* (LD). - **Kenya.** PROV. RIFT VALLEY. DISTR. TRANS NZOIA, Cherangani Mt., *R.A. Geesteranus* 4842 (L). - Mt. Longonot, 9.VIII.1985, *K. Kalb* & *A. Schrögl* (Hb. Kalb). - **Tanzania.** WEST USAMBARA. Mzinga, *J. Brunthaler* 8410 (W). - **Madagascar.** Tannanarive, *Sikora* 14367 (W).

5. *Diploschistes diploschistoides* (Vainio) Salisbury

Lichenologist 5: 273 (1972). - *Thelotrema diploschistoides* Vainio, Ann. Univ. fenn. åbo, ser. A, 2 (3): 31 (1926). Type: Africa, Zimbabwe ("Rhodesia"), Matoppos, granitic rock, 1920, *P. v.d. Byl* 157 (TUR-V 34806 - holotype).

(Fig. 4 B & C)

Syn.: *Diploschistes almbornii* (sub "Almborni") Dodge, Beih. Nova Hedwigia 12: 106 (1964). - Type: South Africa, Cape Prov, Cape Div., Camps Bay (nr. Cape Town), on rocks near the sea, 5.IX.1953, *O. Almborn* [=Almborn, Lich. Africani 27] (BM, L, LD, M - isotypes).

Thelotrema microglauenoides Vainio, Ann. Univ. fenn. åbo, ser. A, 2 (3): 32 (1926). Type: Africa, Zimbabwe ("Rhodesia"), Matoppos, granitic rock, *P. v.d. Byl* 159 (TUR-V 34804 - holotype).

Remarks: In his original publication Vainio (1926) cited the collection number 157 as the type of *Thelotrema microglauenoides*. However all specimens found with this number were identified as *D. diploschistoides* by Vainio. The only specimen found in TUR which was annotated as *Thelotrema microglauenoides* has collection no. 159. Therefore we think that the number reported reported in Vainio's (loc. cit.) paper was a misprint.

Thallus crustose, uniform, adnate, rimose areolate, opaque to shining, dark bluish grey to light grey, epruinose. Areoles 0.2 - 0.9 mm in diam., plane to verrucose. Algae belonging to the genus *Trebouxia*.

Apothecia immersed, perithecioid, disc blackish, epruinose, up to 0.5 mm in diam. Excipulum proprium blackish, up to 90 μm thick, pseudoparenchymatous. Hymenium 110 - 170 μm high. Hypothecium 15 - 20 μm high, hyaline. Paraphyses 1 - 1.5 μm thick, simple and lax. Asci cylindrical to subclavate, 100 - 160 x 15 - 45 μm , 4 - 8 spored. Ascospores hyaline to light brown, muriform, broadly ellipsoid, 4 - 7 transverse septa, 1 - 4 longitudinal septa, 30 - 52 x 15 - 26 μm , I⁺ blue.

Chemistry: major substance: lecanoric acid; minor substances: diploschistesic, $\pm$ gyrophoric and orsellinic acids.

D. diploschistoides is morphologically very similar to *D. actinostomus* and *D. caesioplumbeus*. However it can be separated from *D. actinostomus* by the generally darker thallus and the larger ascospores. *D. caesioplumbeus* is similar to *D. diploschistoides* in both the thallus colour and the spore size, but can be distinguished by its darker, non halonate spores which do not stain intensely blue with iodine. The spores of *D. diploschistoides* usually have a well developed halo which is strongly amyloid.



Fig. 6. Distribution of *D. diploschistoides* in South Africa.

Thelotrema microglaenoides and *Diploschistes diploschistoides* were synonymised by Salisbury (1972) and this synonymy is confirmed here. *D. almbornii* further is a synonym of *D. diploschistoides*. The spore size of *D. almbornii* as reported by Dodge (1964) is erroneous (21-27 x 16-18 μm) with the type containing much larger ascospores (39-52 x 22-26 μm). The thallus of *D. diploschistoides* varies from dark to light grey, but otherwise no variation was observed.

Ecology and distribution: This species occurs on siliceous rocks in similar habitats to *D. actinostomus*. It seems to be restricted to the Southern Hemisphere having been collected in southern Africa, South America (Brazil; e.g. *Kalb 17545* [hb. Lumbsch] and Columbia, e.g. *Sipman 6089* [hb. Lumbsch]) and Australia (Elix 1993). In South Africa the lichen was collected mainly in arid-humid regions, especially in the winter rain zone (Fig. 6).

Selected specimens examined: **South Africa.** CAPE PROVINCE. DIV. OF CAPE, 2 km S of Camps Bay, *O. Almborn* & *I. Kärnefelt* 84918 (LD). - CAPE TOWN, Leeu-wkop, *J. Hafellner* & *A. Hafellner* 32940 (GZU). - DIV. OF CLANWILLIAM, Pak-huispas E of Clanwilliam *O. Almborn* & *I. Kärnefelt* 84914, 84917, 84919 (LD). - DISTR. HUMANSDORP, Tsitsikama Forest, *I. Kärnefelt* 8647-37 (LD). - DIV. OF KNYSNA, The Heads, *O. Almborn* & *I. Kärnefelt* 8433 (LD). - DISTR. PAARL, Paarl Rock, *O. Almborn* 5512 (LD). - DIV. OF SIMONSTOWN, Cape Peninsula, *O. Almborn* & *I. Kärnefelt* 84313, 84314, 84315 (LD). - DIV. OF SWELLENDAM, Transdouw Pass, *O. Almborn* & *I. Kärnefelt* 8428-1 (LD). - DISTR. TARKA, 44 km S of Tarkastad, *I. Kärnefelt* 8636-36 (LD). - DIV. OF WORCESTER, N of Worcester, *O. Almborn* & *I.*

Kärnefelt 8421 (LD). - Dutoitskloofpas E of Paarl, *J. Hafellner* & *A. Hafellner* 32937 (GZU). - NATAL. Royal Natal National Park, *D. Triebel* & *G. Rambold* 6810 (M). - SWAZILAND. DISTR. PEAK, 7 mi E of Havelook, *O. Almborn* 7875 (LD). - TRANSVAAL. DISTR. LYDENBURG, 10 mi SE of Lydenburg, *O. Almborn* 7412 (LD). - DISTR. PIETERSBURG, Houtbosch, *O. Almborn* 82100 (LD). - DISTR. PILGRIMS REST, 3 km E of Pilgrims Rest, *O. Almborn* & *I. Kärnefelt* 8486-12 (LD). - DISTR. ZOUTPANSBERG, Punch Bowl Inn, *O. Almborn* 6511 (LD).

6. *Diploschistes euganeus* (Massal.) Steiner

Verhandl. zool. bot. Ges. Wien **69**: 96 (1919). - *Limboria euganea* Massal., Ricer. Sull. Autonom. Lich. crust.: 155 (1852); a complete description of this species is given by Lumbsch (1989).

(Fig. 4 D)

Chemistry: no secondary metabolites detected.

D. euganeus can be readily distinguished from similar species by its very broad, nearly globose ascospores and the absence of secondary metabolites. The thallus may vary from whitish grey to greyish brown in colour.



Fig. 7. Distribution of *D. euganeus* in South Africa.

Ecology and distribution: This cosmopolitan species occurs on siliceous rocks in open situations in arid and semiarid regions. In South Africa *D. euganeus* occurs in the summer and winter rain zone (Fig. 7).

Selected specimens examined: **South Africa.** BASUTOLAND. DIV. QUACHAS NEK, Black Mt., *L. Kofler* 326 (LD). - DIV. MASERU, Bushman's Pass, 4.V.1963, *L. Kofler* (LD). - CAPE PROVINCE. DISTR. BARKLY EAST, Barkly Pass, *I. Kärnefelt* 8633-8 (LD). - DISTR. CAPE, Table Mt., *Almborn* 1787 (LD). - DISTR. CLANWILLIAM, 3 mi S of Citrusdal, *O. Almborn* 4499 (LD). - DISTR. CRADOCK, Mt. Zebra National Park, *I. Kärnefelt* 8639 (LD). - DISTR. PORT ST. JOHNS, *O. Almborn* 10633 (LD). - DISTR. STELLENBOSCH, Stellenbosch Flats, *O. Almborn* 5304 (LD). - NATAL. DISTR. LADYSMITH, *v.d. Byl* 1279 (STEU). - Royal Natal National Park, *D. Triebel & G. Rambold* 6888 (LD). - ORANGE FREE STATE. DISTR. VENTERSBURG, N of Ventersburg, *O. Almborn* 5845 (LD). - TRANSKEI. DISTR. MATATIELE, Quachas Nek, *I. Kärnefelt* 8630-8 (LD). - TRANSVAAL. DISTR. ZOUTPANSBERG, Wyllie's Port, *O. Almborn* 6422 (LD). - DISTR. CALVINIA, between Calvinia and Middelpos, *v.d. Byl* 579 (STEU).

7. *Diploschistes hensseniae* Lumbsch & Elix

Pl. Syst. Evol. **150**: 276 (1985), for a description see Lumbsch & Elix (1985).

(Fig. 8 A)

Chemistry: major substance: diploschistesic acid; minor substances: lecanoric and orsellinic acids.

D. hensseniae is characterized by the perithecioid ascomata, the whitish pruinosse thallus and the presence of diploschistesic acid. Among the terricolous species occurring in South Africa, *D. hensseniae* is the only species with perithecioid fruiting bodies. *D. thelenelloides*, described from Madagascar (Lumbsch & Aptroot 1993), is another terricolous species with perithecioid ascomata, but differs from *D. hensseniae* in having bullate fertile areolae and lacking diploschistesic acid.

Ecology and distribution: *D. hensseniae* grows on soil in open situations in semiarid regions, especially in the winter rain zone. This species exhibits similar ecology in Australia (Lumbsch & Elix 1985). Hitherto *D. hensseniae* was only known from the southern part of Australia, this being the first record from Africa. In South Africa this species is restricted to the Cape region and Namaqualand (Fig. 9).

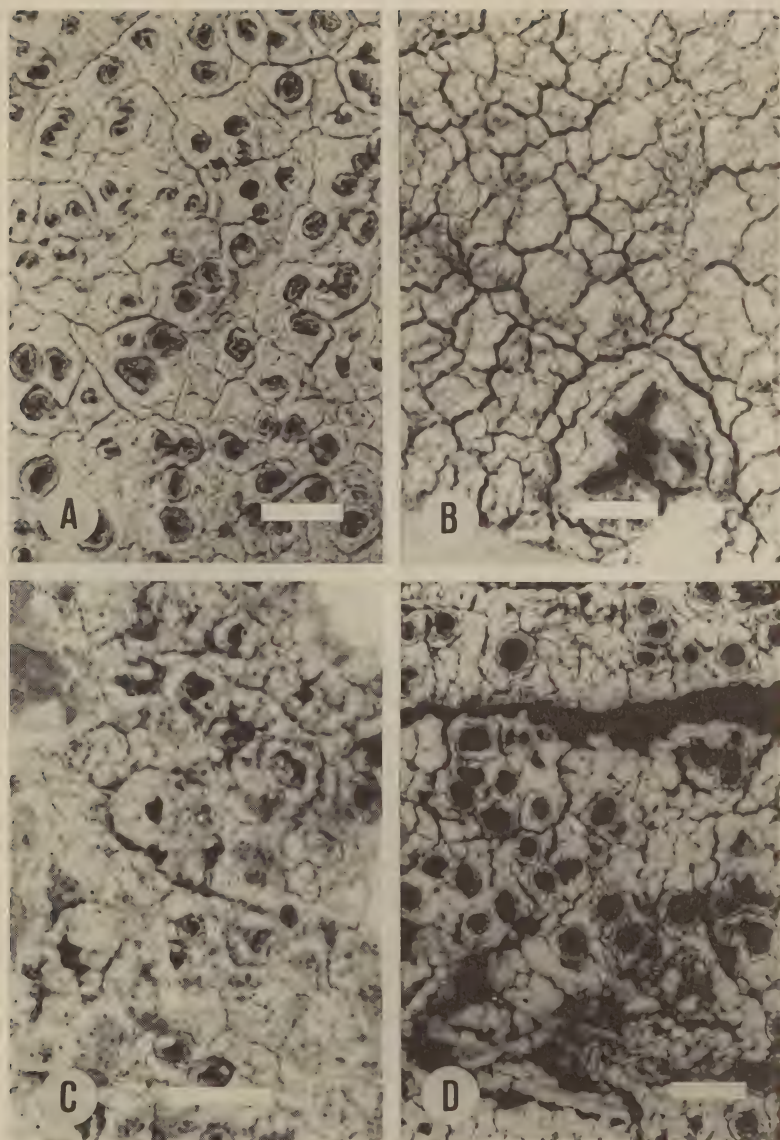


Fig. 8. South African species of *Diploschistes* III. - A. *D. hensseniae*. B. *D. hypo-leucus*. C. *D. isabellinus*. D. *D. muscorum* ssp. *bartlettii*. Scale = 1 mm.



Fig. 9. Distribution of *D. hensseniae* (★) and *D. hypoleucus* (●) in South Africa.

Selected specimens examined: **South Africa.** CAPE PROVINCE. DISTR. WORCESTER, Karoo Botanic Garden, V. Wirth 21383 (STU). - 70 km ENE of Cape Town, 12.XI.1987, W. & U. Wetschnig (GZU). - W of N 7, M.E. Hale 79933 (US). - 15.9 km NE of Barrydale, M.E. Hale 74931 (US). - Stellenbosch, v.d. Byl 13958 (STEU).

8. *Diploschistes hypoleucus* Zahlbr.

Hedwigia 31: 35 (1892). - *Urceolaria hypoleuca* Vainio, Acta Soc. Fauna Flora Fenn. 7:73 (1890); a complete description of this species is given by Lumbsch (1989).

(Fig. 8 B)

Chemistry: major substance: gyrophoric acid; minor substances: lecanoric and orsellinic acids.

The thallus of *D. hypoleucus* has a greenish to brownish colour and the apothecia are often rather large and divided. Morphologically some morphotypes resemble *D. cinereocaesius*. However these two species can be readily distinguished by their chemistry, since *D. hypoleucus* contains gyrophoric acid as major constituent while *D. cinereocaesius* is characterized by the presence of lecanoric acid.

Ecology and distribution: *D. hypoleucus* is a terricolous lichen which occurs in tropical and subtropical regions. Although Lumbsch (1989) proposed that *D. hypoleucus* was a neotropical species. Our recording of this species from Africa

for the first time suggests that *D. hypoleucus* might be pantropical in distribution. The single specimen from South Africa was collected in Natal (Fig. 9), but further specimens have been collected from Central Africa by Serusiaux (Lumbsch unpubl.)

Specimen examined: **South Africa.** NATAL. DISTR. ANDERBERG, Sani Pass, *I. Kärnefelt* 8629-22 (LD).

9. *Diploschistes isabellinus* Zahlbr.

Ann. Crypt. exot. 5: 219 (1932). Type: South Africa, Kapland, Greys Pass, Citrusdal, *P.v.d. Byl* 755 (W-lectotype), for a description of this species see Lumbsch (1993).

(Fig. 8 C)

Chemistry: lecanoric acid.



Fig. 10. Distribution of *D. isabellinus* (★) and *D. ocellatus* (●) in South Africa.

D. isabellinus is characterized by the very thin thallus. A discussion of its relationships can be found in Lumbsch (1993).

Ecology and distribution: This endemic species occurs on sandy soil in the Cape region (Fig. 10). The climate in this area is semiarid with winter rain.

Selected specimens examined: **South Africa.** CAPE PROVINCE. Grey's Pass, Citrusdal, *v.d. Byl* 755 (STEU). - Stellenbosch Flats, 6.II.1930, *A.V. Duthie* (STEU).

10. *Diploschistes muscorum* ssp. *bartlettii* Lumbsch

Herzogia 7: 602 (1987), for a description of this species see Lumbsch (1987).

(Fig. 8 D)

Chemistry: major substances: lecanoric and diploschistesic acid; minor substance: orsellinic acid.



Fig. 11. Distribution of *D. muscorum* ssp. *bartlettii* in South Africa.

D. muscorum ssp. *bartlettii* is a geographical race of *D. muscorum*, which occurs in the Southern Hemisphere, and is characterized by the eight-spored asci. The Northern Hemisphere race, *D. muscorum* ssp. *muscorum*, differs in having a smaller hymenium and four-spored asci.

Ecology and distribution: When juvenile this lichen is a parasite on different *Cladonia* spp. Even at the margins of mature thalli one can often find fragments of the host. *D. muscorum* is a cosmopolitan species which occurs in all zonobiomes. In South Africa this subspecies is very common and widely distributed (Fig. 11), although it has been collected mainly in the Cape region and the mountains of Lesotho.

Selected specimens examined: **South Africa**. CAPE PROVINCE. DISTR. BARKLY EAST, Naudesnek, *I. Kärnefelt* 8632-1, 8632-2 (LD). - Nauders Nek, *L. Kofler* 31115 (LD). - DISTR. CAPE, Cape of Good Hope, Table Mt., IX.1874, *E.A. Eaton* (BM). - DIV. OF CLANWILLIAM, Pakhuispas E of Clanwilliam, *O. Almborn* & *I. Kärnefelt* 8413-3, 8413-8 (LD). - Dutoitskop NW of Franschhoekpas, *J. Hafellner* & *A. Hafellner* 32936 (GZU). - WELLINGTON, Bankloof Pass, *V. Wirth* 21382 (STU). -

DIV. OF WORCESTER, N of Worcester, *O. Almborn & I. Kärnefelt* 8421-8 (LD). - Gudeskoom, Cango Coves, *Arnell* 1430 (UPSV). - NATAL. DISTR. BERGVILLE, Royal Natal National Park, *I. Kärnefelt* 8626-37, 8626-38 (LD). - TRANSKEI. DISTR. MOUNT FLETCHER, Lusi Poort, *I. Kärnefelt* 8631-25 (LD). - TRANSVAAL. PILGRIMS REST DISTRICT, Mac Mac Falls, *I. Kärnefelt* 8622 (LD). - LESOTHO. DIV MASERU, Makhalong River Valley, 31.V.1962, *L. Kofler* (LD). - DIV. QUACHAS NEK, Mokhotlong Mt., *L. Kofler* 32811 (LD).

Kenya. CENTRAL PROVINZ, DISTR. NANYUKI, between Naro Maru and Nanyuki, *K. Kalb & A. Schrögl* 13365, 13484, 13485, 13486 (Herb.Kalb). - Mount Kenya National Park, *K. Kalb & A. Schrögl* 13685 (Herb.Kalb). - DISTR. NYERI, Aberdare National Park, *K. Kalb & A. Schrögl* 13770 (Herb.Kalb).

11. *Diploschistes ocellatus* (Vill.) Norman

Nyt. Mag. Naturvid. 7: 232 (1853). - *Lichen ocellatus* Vill., Hist. Plant. Dauph.: 988 (1789); a complete description of this species is given in Lumbsch (1989).

(Fig. 13 A)

Chemistry: major substance: norstictic acid; minor substances: connorstictic, cryptostictic and stictic acids.

D. ocellatus is easily recognized by its large apothecioid ascomata with open, non-urceolate, discs. Furthermore the thallus is rather thick, bullate-areolate and heavily pruinose. Chemically the species is characterized by the presence of the depsidone, norstictic acid.

Ecology and distribution: This species occurs on calciferous rocks and soil, especially in dry regions. Interestingly, *D. ocellatus* is known from Eurasia, Australia and Southern Africa, but no collections are known from the Western Hemisphere. In Southern Africa, this species is very rare, with only two collections from Namibia examined (Fig. 10).

Specimens examined: **Namibia.** Neudamm, *O. Volk & V. Wirth* 21379 (STU). - Gamsberg, III.1972, *M. Fuchs* (STU).

12. *Diploschistes scruposus* (Schreb.) Norman

Nyt. Mag. Naturvid. 7: 232 (1853). - *Lichen scruposus* Schreb., Spic. Fl. Lips.: 133 (1771); a complete description of this species is given in Lumbsch (1989).

(Fig. 13 B)

Chemistry: chemical race I: major substance: lecanoric acid; minor substance: orsellinic acid. chemical race II: major substances: lecanoric and diploschistesic acids; minor substance: orsellinic acid.



Fig. 12. Distribution of *D. scruposus* (★) and *D. thunbergianus* (●) in South Africa.

D. scruposus is a saxicolous species which is characterized by its apothecioid ascomata with urceolate discs. Some morphotypes can be similar to *D. muscorum* spp. *bartlettii*, but this taxon differs in having smaller spores and by being parasitic on *Cladonia* when juvenile.

Ecology and distribution: This saxicolous lichen occurs on more or less exposed siliceous rocks. It has a cosmopolitan distribution and occurs in numerous zonobiomes. While it is a very common lichen in the Northern Hemisphere, only a few collections have been made in South Africa in the Cape region, Lesotho and Namibia (Fig. 12).

Selected specimens examined: **South Africa.** CAPE PROVINCE. DISTR. PAARL, Paarl Rock, *O. Almborn* 5410 (LD). - DISTR. SOMERSET WEST, False Bay, *R.A. Geesteranus* 6744 (L). - Dutoitskloofpas E of Paarl, *J. Hafellner* & *A. Hafellner* 32938 (GZU). - LESOTHO. DIV. LERIBE, Oxbow Valley, *L. Kofler* 311296 (LD). - **Namibia.** Okakaruru, Waterberg-Plateau, *V. Wirth* & *D. Wessels* 18387 (STU).

13. *Diploschistes sticticus* (Körber) Müll. Arg.

Bull. Herb. Boissier 2, app. 1: 52 (1894). - *Urceolaria stictica* Körber, Abh. Schles. Ges. Vaterl. Cult. 40, 2 a: 32 (1863), for a description of this species and its synonymy see Lumbsch & Elix (1989).

(Fig. 13 C)

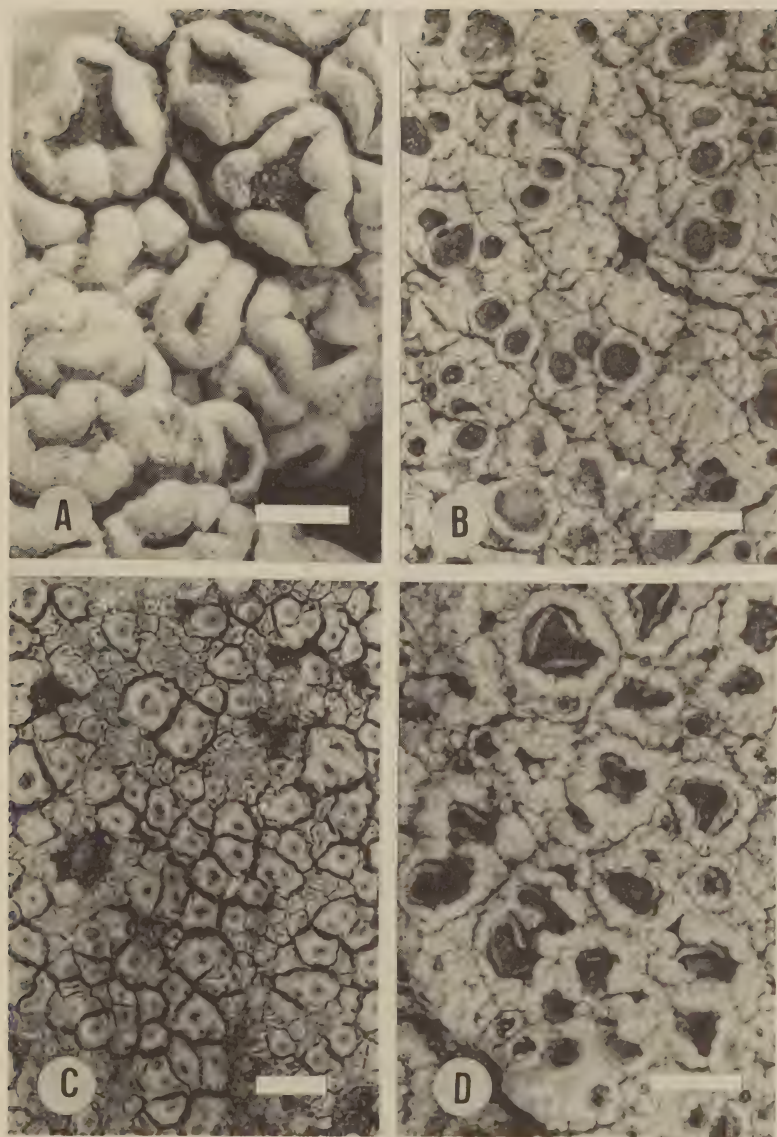


Fig. 13. South African species of *Diploschistes* IV. - A. *D. ocellatus*. B. *D. scruposus*. C. *D. sticticus*. D. *D. thunbergianus*. Scale = 1 mm.

Chemistry: major substance: gyrophoric acid; minor substances: lecanoric and orsellinic acids.

Morphologically *D. sticticus* resembles *D. euganeus*, but is distinguished by the narrower ascospores and the presence of gyrophoric acid. Furthermore the thallus of *D. sticticus* is generally darker and better developed.

Ecology and distribution: This species occurs on exposed siliceous rocks in temperate to subtropical regions of Australia and Southern and Central Africa. In South Africa it was collected in the Cape region, Lesotho and Transvaal (Fig. 14).



Fig. 14. Distribution of *D. sticticus* in South Africa.

Selected specimens examined: **South Africa.** CAPE PROVINCE. DISTR. CAPE, Table Mt., *O. Almborn* 1786 (LD). - Cape Town, Leeukop, *J. Hafellner* & *A. Hafellner* 32941, 32946 (GZU). - DISTR. EAST LONDON, 2 mi NE of Potsdam, *O. Almborn* 10687 (LD). - DIV. OF NAMAQUALAND, S of Kanieskroon, *O. Almborn* & *I. Kärnefelt* 8420-11 (LD). - Garagams, *O. Almborn* & *I. Kärnefelt* 8418-45 (LD). - DISTR. PAARL, Paarl Rock, *O. Almborn* 5522, 5546 (LD). - DISTR. STELLENBOSCH, Stellenbosch Flats, *O. Almborn* 5312 (LD). - DISTR. WELLINGTON, Bainskloof, *O. Almborn* 5202, 5221 (LD). - Bains Kloof, *O. Almborn* 5121 (LD). - Massenberg, *D. Triebel* & *G. Rambold* 8481 (M). - Klein-Swartberge, *D. Triebel* & *G. Rambold* 7934, 7936, 7938, 7939 (M). - NATAL. DISTR. BERGVILLE, Cathedral Peak area, *O. Almborn* 8977 (LD). - Drakensberge, Van Reenen Pass, 1909, *J. Brunnthaler* (W). - DISTR. EASTCOURT, Gaint's Castle Game Reserve, *I. Kärnefelt* 8628-68 (LD). - TRANSVAAL. DISTR. LYDENBURG, 5 mi E of Mokobulaan, *O. Almborn* 7445 (LD). - DISTR. PIETERSBURG, Ben Levin Nature Reserve S of Louis Trichardt, *I. Kärnefelt* 8613-8 (LD). - 6 mi N of Houtbosch, *O. Almborn* 6749 (LD). - DISTR. PILGRIMS

REST, 4 mi SE of Pilgrims Rest, *O. Almborn* 7832 (LD). - 3 km E of Pilgrims Rest, *O. Almborn* & *I. Kärnefelt* 8486-13 (LD). - Graskop, *O. Almborn* & *I. Kärnefelt* 8487-1 (LD). - **Kenya**. RIFT VALLEY. DISTR. KAJIADO, between Namanga and Kajiado, *K. Kalb* & *A. Schrögl* 13303 (Herb.Kalb). - Mt. Longonot, *K. Kalb* & *A. Schrögl* 14299 (Herb.Kalb).

14. *Diploschistes thunbergianus* (Ach.) Lumbsch & Vezda

in Lumbsch, Nova Hedwigia **56**: 234 (1993). - *Gyalecta thunbergiana* Ach., Lich. Univ.: 152 (1810), nom. nov. pro *Lichen excavatus* Thunb. ex Ach., Meth. Lich.: 148 (1803), non Haller in Relhan, Flora Cantabr.: 426 (1785). - Type: "Cap. B. Spei" (UPS-Thunberg 21111-holotype), for a description of this species see Lumbsch (1993).

(Fig. 13 D)

Chemistry: major substances: lecanoric and diploschistesic acids; minor substance: orsellinic acid.

D. thunbergianus is characterized by the whitish, pruinose thallus, the verrucose areolae and the apothecoid ascomata with urceolate discs. *D. diacapsis* is morphologically similar, but differs in having larger areolae and ascospores.

Ecology and distribution: *D. thunbergianus* is a terricolous lichen which occurs mainly in the winter rain zone. With a few exceptions, all collections in South Africa were made in the arido-humide zonobiome. *D. thunbergianus* has been recorded from Australia and Southern Africa (Lumbsch 1993). In South Africa most collections were made in the western part of the Cape Province (Fig. 12).

Selected specimens examined: **South Africa**. CAPE PROVINCE. DIV. OF NAMAQUALAND, 5 km SE of Nieuwoudtville, 8.IX.1987, W. & U. Wetschnig (GZU). - Gudeskoom, Cango Caves, *Arnell* 1424 (UPSV). - 26.4 km E of Ladismith, *M.E. Hale* 73843 (US). - 46 km SW of Swellendam, 25.IX.1987, W. & U. Wetschnig (GZU). - LESOTHO. DIV. LERIBE, Oxbow Valley, *L. Kofler* 3112928 (LD).

We wish to thank the curators of the herbaria cited and the private collectors for sending us specimens in their care for examination. We thank Prof. Dr. J.A. Elix (Canberra) and Prof. Dr. G.B. Feige (Essen) for their comments on the manuscript.

References

- Abu-zinada, A. H., Hawksworth, D. L. & Bokhary, H. A. (1986). The lichens of Saudi Arabia, with a key to the species reported. *Arab Gulf J. Sci. Res., Spec. Publ.* **2**: 1-54.
- Culberson, C.F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chro-*

matogr. **72**: 113-125.

- Culberson, C.F. & A. Johnson (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in standardized thin-layer chromatographic method for lichen products. *J. Chromatogr.* **238**: 438-487.
- Dodge, C. (1964). Some Lichens of Tropical Africa. IV. Dermatocarpaceae to Pertusariaceae. *Beih. Nova Hedwigia* **12**: 1-282.
- Elix, J.A. (1993). *Lichenes Australasici Exsiccati. Fasc. 11*. Canberra.
- Feige, G. B., Lumbsch, H. T., Huneck, S. & Elix, J. A. (1993). The identification of lichen products by a standardized high-performance liquid chromatographic method. *J. Chromatogr.* **646**: 417-427.
- Guderley, R. (1995). *Taxonomische Untersuchungen an südafrikanischen Vertretern der Flechtengattung Diploschistes*. Staatsexamensarbeit, Univ. Essen.
- Lumbsch, H.T. (1987). Eine neue Subspecies in der Flechtengattung *Diploschistes* aus der Südhemisphäre. *Herzogia* **7**: 601-608.
- Lumbsch, H. T. (1989). Die holarktischen Vertreter der Flechtengattung *Diploschistes* (*Thelotrema*aceae). *Journ. Hattori Bot. Lab.* **66**: 133-196.
- Lumbsch, H. T. (1993). Studien über die Flechtengattung *Diploschistes* I. *Nova Hedwigia* **56**: 227-236.
- Lumbsch, H. T. & Aptroot, A. (1993). Studien über die Flechtengattung *Diploschistes* II. *Nova Hedwigia* **56**: 237-239.
- Lumbsch, H. T. & Elix, J. A. (1985). A new species of the lichen genus *Diploschistes* from Australia. *Pl. Syst. Evol.* **150**: 275-279.
- Lumbsch, H. T. & Elix, J. A. (1989). Taxonomy of some *Diploschistes* spp. (lichenized ascomycetes, *Thelotrema*aceae) containing gyrophoric acid. *Pl. Syst. Evol.* **167**: 195-199.
- Lumbsch, H. T., Feige, G. B. & Egea, J. M. (1993). Two lichens new to Europe. *Lichenologist* **25**: 303-306.
- Lumbsch, H.T. & Mayrhofer, H. (1990). A new species of the lichen genus *Diploschistes* from India. *Mycotaxon* **38**: 311-313.
- Magnusson, A. (1956). New European lichens. *Bot. Not.* **109**: 143-152.
- Pant, G. & Upreti, D. K. (1993). The lichen genus *Diploschistes* in India and Nepal. *Lichenologist* **25**: 33-50.
- Salisbury, G. (1972). *Thelotrema* Ach. sect. *Thelotrema*. 1. The *T. lepadinum* group. *Lichenologist* **5**: 262-274.
- Stizenberger, E. (1890). Lichenaea Africana. *Ber. Thätigk. St. Gall. Naturw. Ges.* **1889/90**: 133-268.
- Vainio, E.A. (1926). Lichenes Africani Novi. *Ann. Univ. fenn. abo. ser. A*, **2**(3): 25-40.

THE GENUS *DIMELAENA* (LICHENIZED ASCOMYCETES, PHYSCIACEAE) IN THE SOUTHERN HEMISPHERE

Helmut MAYRHOFFER*, Mario MATZER*, Anita WIPPEL*,
and John A. ELIX°

*Institut für Botanik, Karl-Franzens-Universität Graz, Holteigasse 6,
A-8010 Graz, Austria

°Department of Chemistry, The Australian National University, Canberra,
ACT, 0200, Australia

ABSTRACT: Four species of the genus *Dimelaena* occurring in the southern hemisphere are treated. *Dimelaena australiensis* is reported from South Africa, South America, Western Australia and Tasmania for the first time. *D. elevata* from tropical Australia is described as new to science. The chemotype II (usnic acid, gyrophoric acid) of *D. oreina* is found in South Africa and South America. The new combination *D. tenuis* is proposed for this tropical to subtropical species, which is recorded from Venezuela, Colombia, South Africa, Northern Territory (Australia), New Caledonia and Papua New Guinea for the first time. *D. diffractella* and *D. somaliensis* are synonyms of *D. tenuis*. Descriptions are presented for all taxa, and their chemistry, ecology and distribution are discussed.

INTRODUCTION

Historically the small crustaceous genus *Dimelaena* was included in *Rinodina* (Zahlbruckner 1926) but following Poelt (1969) and Hale & Culbertson (1970), Sheard (1974) treated it as a separate genus, redefining its limits to include only those species with an unthickened spore wall and a radiate-plicate thallus margin. The presence of apothecia which are initially cryptolecanorine but finally become lecanorine to lecideine, and of a dark hypothecium in a number of species suggests that *Dimelaena* is more closely related to *Buellia* rather than to *Rinodina*. This view is supported by the presence of *Bacidia*-type asci (Rambold & al. 1994) with a conical axial body (fig. 1), and ascospores of the *Beltraminia*-type (figs 2 - 5) usually lacking internal wall-thickenings and

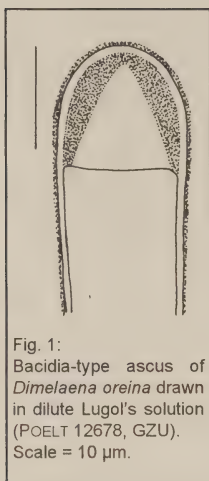


Fig. 1:
Bacidia-type ascus of
Dimelaena oreina drawn
in dilute Lugol's solution
(POELT 12678, GZU).
Scale = 10 μ m.

possessing a distinct torus around the septum. Both of these characters are also found in the bulk of the species belonging to the genus *Buellia*. The spermogonia are always globose to pyriform and immersed in the thallus, and the spermatia are bacilliform. Five species were accepted by SHEARD (1974), with two more added by SHEARD & MAYRHOFFER (1984). A further species was described by ALSTRUP & al. (ALSTRUP & APTROOT 1994) but, in the present work, this is regarded as a synonym of *D. tenuis*. All known species are saxicolous and occur on siliceous rocks. Four species of *Dimelaena* have been recorded from the southern hemisphere: *D. oreina* from South America (CENGIA SAMBO 1927, as *Rinodina oreina* var. *fimbriata*) and from South Africa (DRÈGE 1843, as *Lecanora oreina*; DOIDGE 1950, as *Rinodina oreina*); *D. tenuis* (as *D. diffractella*) from Australia and South America (SHEARD 1974, 1977), *D. australiensis* from Australia (SHEARD & MAYRHOFFER 1984) and *D. elevata* ined. from

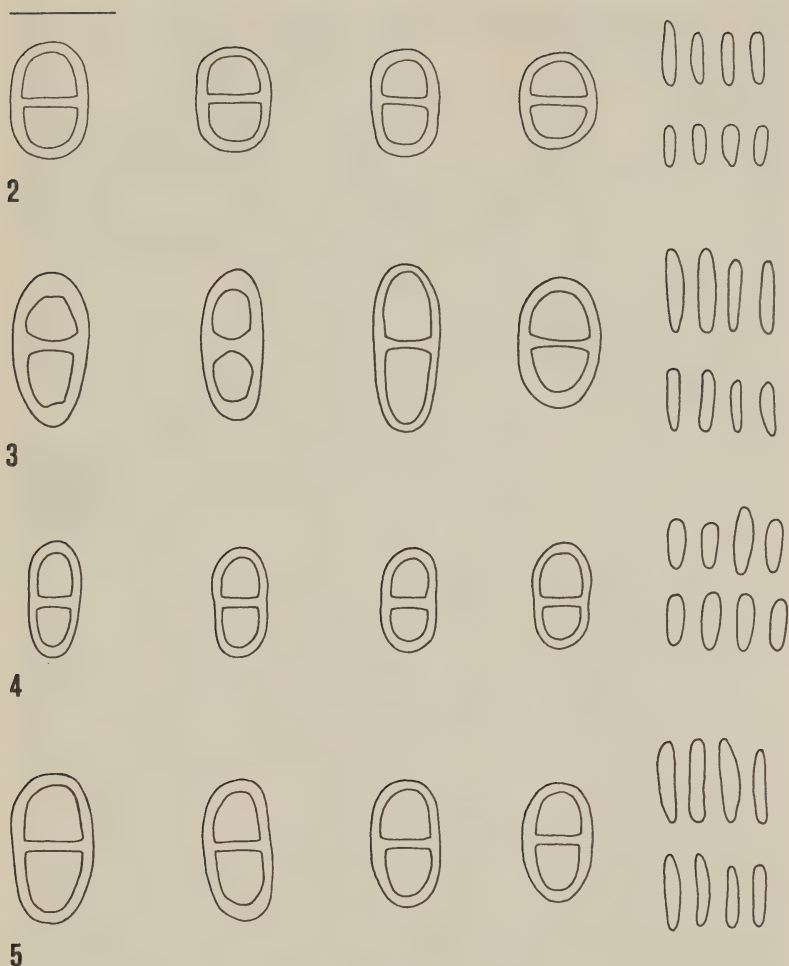
tropical Australia (MAYRHOFFER & al. 1994). The report of *D. thysanota* from Australia (MAYRHOFFER & al. 1994) probably refers to a new species of an undescribed genus.

METHODS

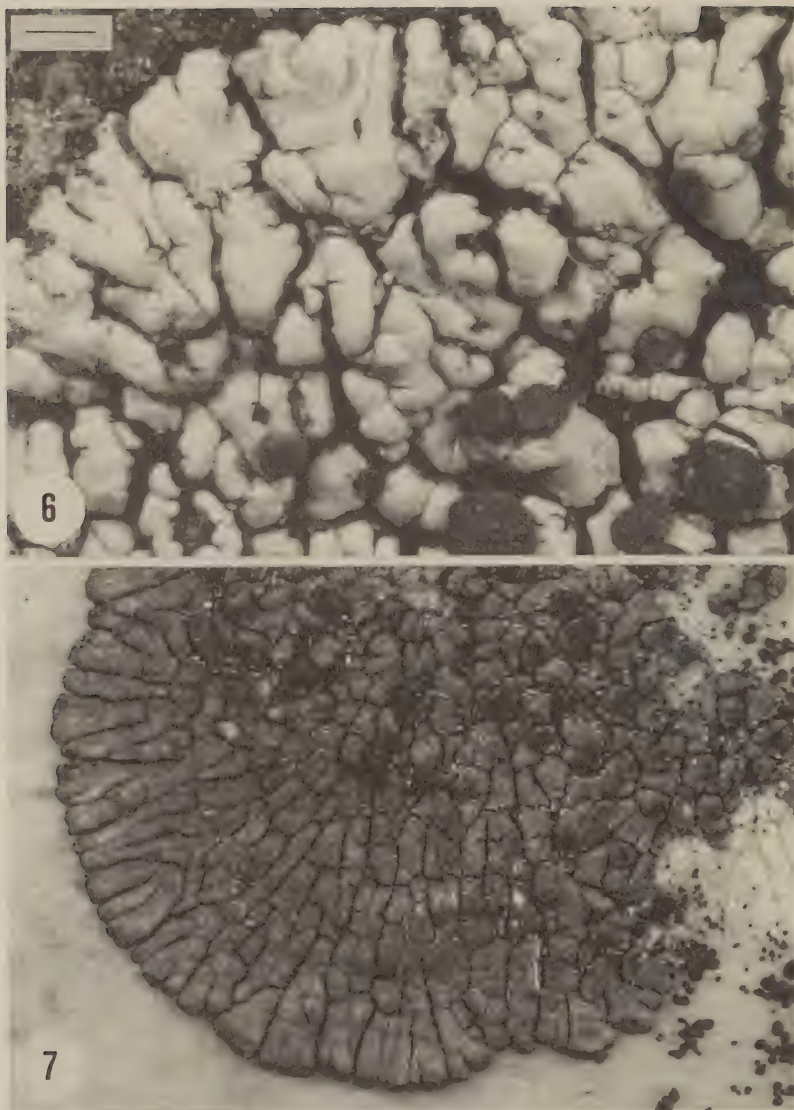
Standard light microscopic techniques were employed for the examination of specimens. Habit photographs were taken with a Wild M3B microscope. For the identification of lichen substances, standardized methods for thin-layer chromatography were used as described by CULBERSON & AMMANN (1979) and CULBERSON & JOHNSON (1982), and for HPLC as described by FEIGE & al. (1993).

KEY TO THE SPECIES

- | | | |
|----|--|--------------------------------|
| 1 | Thallus yellowish white to pale yellow | 2 |
| 1* | Thallus white, grey or brown | 3 |
| 2 | Apothecia becoming lecideine. Hypothecium dark brown. Thallus areoles convex and loosely attached | <i>D. elevata</i> |
| 2* | Apothecia lecanorine. Hypothecium hyaline. Thallus areoles plane and broadly attached | <i>D. oreina</i> |
| 3 | Thallus white, grey or light grey-brown, margins with rather short lobes. Ascospores 7 - 10 x 5 - 7 μ m, many nonseptate ones present. Chemistry: sulphurellin | <i>D. australiensis</i> |
| 3* | Thallus light brown to dark brown, often glossy, margins with long lobes. Ascospores 9 - 14 x 5 - 8 μ m, nonseptate ones rarely present. Chemistry: gyrophoric and 5-O-methylhiassic acids | <i>D. tenuis</i> |



Figs 2 - 5: Ascospores and spermatia of *Dimelaena* species. 2: *D. australiensis* (Australia, N.S.W., Parlour Mt., 18.9.1992, A. WIPPEL, GZU). 3: *D. elevata* (ascospores: MAYRHOFER 11365, GZU; spermatia: ELIX 22526, CANB). 4: *D. oreina* (BRUSSE 5776, GZU). 5: *D. tenuis* (Australia, Qld, Mt. Barney National Park, 12.9.1992, A. WIPPEL, GZU). Scale = 10 μ m.



Figs 6 - 7: Habit photographs of *Dimelaena* species. Note the radiate-plicate thallus margins. 6: *D. elevata* (ELIX 28019, CANB). 7: *D. tenuis* (MAYRHOFER 11658, GZU). Scale = 0.5 mm.

THE SPECIES

1. *Dimelaena australiensis* H. MAYRHOFFER & SHEARD

SHEARD & MAYRHOFFER, Bryologist 87: 247 (1984)

Type: Australia, New South Wales: New England, Armidale Distr., 35 km NW of Armidale, Parlour Mountain area, ca. 1000 m, 11.10.1981, H. MAYRHOFFER 3492 & J. WILLIAMS (GZU - holotype, MEL - isotype).

Exs.: VEZDA: Lich. rar. exs. 131 (BM, CANB, DUKE, ESS, GZU, H, HO, M, PRM, STU, TSB, UPS, VBI, hb. Kalb, hb. Vezda).

Description: Thallus thin, white, light grey to grey or light grey-brown, rimose-areolate, margin of radiating lobes limited by a narrow, dark prothallus. Apothecia to 0.3 mm diam., innate at first, becoming adnate (cryptolecanorine). Disc black, plane to convex, thalline margin concolorous with thallus, poorly developed and 0.05 mm wide, often incomplete and frequently disappearing. Hymenium 40 - 70 µm high, paraphyses 1.5 - 2 µm wide, apices to 4 µm thick, pigmented brown and immersed in dispersed pigment forming a dark brown aeruginose ephymenium, reacting K-, N+ red. Hypothecium hyaline to pale brown, to 125 µm deep. Ascospores (fig. 2) broadly ellipsoid, 7 - 10 x 5 - 7 µm, with many non-septate ascospores present. Spermatia (fig. 2) bacilliform, 4 - 6 x 1 µm.

Chemistry: Sulphurellin (LEUCKERT & MAYRHOFFER 1985). Spot tests: K-, C+ red, P-.

Distribution (figs 8 - 9): *Dimelaena australiensis* occurs in temperate regions of the southern hemisphere. It is reported here from South America, South Africa, Western Australia, southernmost Queensland and Tasmania for the first time. Hitherto it was known only from New South Wales and Victoria in Australia (SHEARD & MAYRHOFFER 1984, VEZDA 1994).

Ecology: In Australia *D. australiensis* grows on dry, mainly east-facing overhanging surfaces of hard siliceous rocks (e.g. granite, quartzite) in open, dry sclerophyll forests or pastures.

Discussion: *D. australiensis* resembles a diminutive *D. tenuis* and both species exhibit similar apothecial structures. The former species is distinguished by the short and broadly-ellipsoid ascospores, shorter spermatia, aeruginose ephymenium pigmentation, the presence of sulphurellin, different ecology and different distribution patterns.

Additional specimens examined: AFRICA: Republic of South Africa: **Cape Province:** Groot-Swartberge, narrow valley N of Swartbergpass, about 6 km S of Prince Albert, 3322AC, 22°03'10"E / 33°17'35"S, ca. 800 m, 20.2.1992, J. HAFELLNER 30652 & A. HAFELLNER (hb. Hafellner). - **Transvaal:** Pretoria, Donkerport, 3.1943, E. M. DOIDGE 4582 (PRE).

SOUTH AMERICA: Argentina: **Prov. Buenos Aires:** Sierra de la Ventana, Gruta de la Paloma, 23.10.1987, V. ROSATO (GZU).

AUSTRALIA: **New South Wales:** New England, Guyra, Armidale Distr., Parlour Mt., 37 km NW of Armidale, ca. 900 m, 18.9.1992, A. WIPPEL (VEZDA: Lich. rar. exs. 131; CANB, NSW). - Gunning, Federal Highway ca. 42 km NE of Canberra, E-facing rock outcrops above the shore of Lake George, ca. 730 m, 25.7.1992, H. MAYRHOFFER 10647, 10648, D. MAYRHOFFER & E. HIERZER (CANB, GZU, M, MEL). - **Queensland:** Stanthorpe, ca. 30 km S of Stanthorpe, Granite Belt, Girraween National Park, Pyramids Road in direction to Storm King Dam, ca. 0.7 km outside the park, 9.9.1992, A. WIPPEL (GZU). - Same locality, ca. 1.5 km outside the park, 10.9.1992, A. WIPPEL (BRI, CANB, GZU, M, MEL). - **Tasmania:** New Norfolk, ca. 50 m, 42°46'S / 147°04'E, 3.8.1992, H. MAYRHOFFER 10657, E. HIERZER & G. KANTVILAS (CANB, GZU, HO). - Ca. 5 km NE Tanina Bluff, vicinity of Elderslie, sandstone, 42°38'S / 147°04'E, ca. 200 m, 3.8.1992, H. MAYRHOFFER 12037, E. HIERZER & G. KANTVILAS (GZU, HO). - **Western Australia:** Albany Region, Torndirrup National Park S of Albany, ca. 100 m, 23.8.1988, H. MAYRHOFFER 8468, D. & M. MAYRHOFFER (GZU).

2. *Dimelaena elevata* ELIX, KALB & WIPPEL sp. nov.

Thallus plerumque crassus, rimosi-areolatus, ad marginem ± effiguratus, areolis lobisque dispersis, valde convexus, subtus canaliculatus, infirme adnatis, flavidialbidis vel flavidis. Prothallus non distinctus. Apothecia 0.15 - 0.6 mm in diam., primum cryptolecanorina, demum lecideina, sessilia, discis atris subconcavis vel subconvexis et marginibus atris crassiusculis. Hypothecium fuscoatrum. Paraphyses 2 - 3 µm crassae. Ascospores 10 - 16 x 5 - 9 µm, saepe unicellulares, non ornamentatae. Spermatia 5 - 8 x 1 µm.

Type: Australia: Northern Territory, Litchfield National Park, ca. 100 km S of Darwin, 13°07'S / 130°45'E, 200 m, 8.-9.9.1992, A. & K. KALB 25584 (CANB - holotype; GZU, hb. Kalb - isotypes).

Description: Thallus (fig. 6) thick, yellowish white to pale yellow, rimose-areolate, margin radiate-plicate. Areoles convex, constricted at the base and somewhat loosely attached to the substrate, without a distinct prothallus. Apothecia 0.15 - 0.6 mm in diam., cryptolecanorine at first, becoming lecideine, adnate to sessile. Disc black, plane to slightly convex with a distinct, paler exciple. Hymenium 75 - 100 µm tall. Paraphyses 2 - 3 µm wide, apices to 5 µm thick, pigmented red-brown and forming a brown epihymenium. Hypothecium to 200 µm deep, dark brown. Ascospores (fig. 3) 10 - 16 x 5 - 9 µm, with many non-septate ascospores present, apical internal wall-thickenings in the ascospores may occur. Spermatogonia immersed, pyriform. Spermatia (fig. 3) bacilliform, 5 - 8 x 1 µm.

Chemistry: chemotype I: atranorin, norstictic acid, connorstictic acid, xanthonones (tab. 1), chemotype II: atranorin(±), stictic acid, constictic acid, xanthonones (tab.

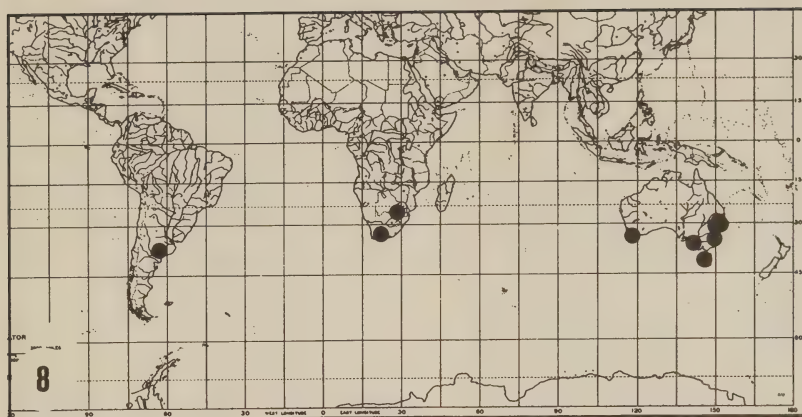


Fig. 8: Distribution of *Dimelaena australiensis*.

Fig. 9: Distribution of *Dimelaena australiensis* and *D. tenuis* in Australasia:

■ *D. australiensis*; ● *D. tenuis*.

1). Spot tests: K+ yellow to orange-brown, C+ yellow to orange (-brown) or reddish, P- or + yellowish.

Tab. 1: Xanthones of *Dimelaena elevata*

6-O-methylarthothelin (major)	ELIX & BENNETT (1990)
1,3,6-tri-O-methylarthothelin (minor)	ELIX & al. (1991)
2,4,5-trichlorolichexanthone (minor)	ELIX & CROOK (1992)
2,5-dichloro-6-O-methylnorlichexanthone (traces)	ELIX & al. (1991)
4,5-dichloro-6-O-methylnorlichexanthone (traces)	ELIX & CROOK (1992)
thiophaninic acid (minor)	
arthothelin (traces)	ELIX & CROOK (1992)
4,5-dichlorolichexanthone (minor)	
2,4-dichlorolichexanthone (minor)	
2,5-dichlorolichexanthone (minor)	
2,5,7-trichlorolichexanthone (minor)	

Distribution: *Dimelaena elevata* is known only from tropical Australia (fig. 10). It has been reported previously from Western Australia as *D. cf. australiensis* (ELIX & CROOK 1992) and as a *Dimelaena* sp. (ELIX & BENNETT 1990, ELIX & al. 1991).

Ecology: *D. elevata* occurs on sheltered boulders of various siliceous rock types but predominantly on sandstone in savannahs and open dry sclerophyll forests.

Discussion: *D. elevata* is characterized by its yellowish, thick and loosely attached thallus and its lecideine apothecia. According to ELIX & CROOK (1992) it possesses the most extensive cohort of chloro-xanthones (tab. 1) yet encountered in any lichen species.

Additional specimens examined (* indicates chemotype I): AUSTRALIA: **Western Australia:** Lake Argyle Road, 31 km SE of Kununurra, on sandstone rocks, 15°59'S / 128°56'E, 160 m, 8.7.1991, J. A. ELIX 27786, 27811, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Gibb River Road, 69 km SW of Wyndham, on sandstone rocks, 15°50'S / 127°35'E, 280 m, 10.7.1991, J. A. ELIX 27857, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Gibb River Road, 45 km SSE of Wyndham, on sandstone rocks, 15°53'S / 128°14'E, 140 m, 16.7.1991, J. A. ELIX 28062, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Gibb Range, Gibb River Road, 37 km NE of Gibb River Station, on semi-exposed boulders, 16°06'S / 126°35'E, 440 m, 13.7.1991, H. STREIMANN 48443 (CANB)*. - King Leopold Range, Ferny Creek, 61 km NE of the Lennard River crossing, along the Gibb River Road, on sheltered rocks, 17°10'S / 125°10'E, 400 m, 14.5.1988, J. A. ELIX 22205, 22213, H. STREIMANN & D. J. GALLOWAY (CANB). - King Leopold Range, Inglis Gap, 46 km NE of the Lennard River crossing, along the Gibb River road, on sheltered rocks, 17°07'S / 125°10'E, 13.5.1988, J. A. ELIX 22195, H. STREIMANN & D. J. GALLOWAY (CANB). - **Northern Territory:** Wangi Road, Finnis Range, 69 km SSW of Darwin, on shaded rocks, 13°05'S / 130°42'E,

120 m, 1.1.1985, H. STREIMANN 8793 (CANB). - Umbrawarra Gorge, 22 km SW of Pine Creek, on sandstone rocks, 13°59'S / 131°41'E, 220 m, 23.5.1988, J. A. ELIX 22526 & H. STREIMANN (CANB)*. - Barolba Creek, 16 km SSE of Jabiru Airfield, on top of shaded boulder, 12°49'S / 132°55'E, 200 m, 21.4.1989, H. STREIMANN 42340 (CANB). - Same locality, H. Streimann 42341 (B). - Baroalba Creek, 15 km SSE of Jabiru airfield, on boulder in wide gorge, 12°48'S / 132°55'E, 200 m, 22.4.1989, H. STREIMANN 42370 (B, CANB). - UDP Falls, 92 km SE of Jabiru, Kakadu National Park, on sheltered rocks in remnant monsoon forest, along rocky creek side, 13°26'S / 132°25'E, 250 m, 24.5.1988, J. A. ELIX 22542 & H. STREIMANN (CANB)*. - Newcastle Range, 12 km SSW of Timber Creek, on semi-exposed rock outcrop, 15°45'S / 130°26'E, 260 m, 13.4.1989, H. STREIMANN 42066 (CANB). - Newcastle Range, 8 km SSW of Timber Creek, on shaded rock face, 15°43'S / 130°28'E, 210 m, 11.4.1989, H. STREIMANN 42015 (B). - Escarpment 7 km SE of Timber Creek, on sandstone rocks, 15°43'S / 130°28'E, 160 m, 7.7.1991, J. A. ELIX 27765, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Arnhem Land, 19 km ENE of Jabiru, on shaded boulder, 12°37'S / 133°03'E, 140 m, 18.4.1989, H. STREIMANN 42255 (B, CANB). - Table Top Range, Litchfield Park, 25 km SE of Batchelor, sandstone rocks, 15°11'S / 130°50'E, 180 m, 2.7.1991, J. A. ELIX 27500, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Litchfield Park, 39 km SW of Batchelor, on sandstone rocks, 13°12'S / 130°41'E, 120 m, 4.7.1991, J. A. ELIX 27640, 27643, 27654*, 27655, 27656, H. T. LUMBSCH & H. STREIMANN (CANB). - 'Lost City', Litchfield Park, 37 km SW of Batchelor, on sandstone rocks, 13°13'S / 130°44'E, 150 m, 4.7.1991, J. A. ELIX 27676, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Donkey Escarpment, head of Donkey Creek, 27 km S of Drysdale River Station, on sandstone rocks, 15°58'S / 126°22'E, 420 m, 15.7.1991, J. A. ELIX 28019, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Joes Creek, 5 km NW of Victoria River Crossing, on sandstone rocks, 15°37'S / 131°05'E, 100 m, 6.7.1991, J. A. ELIX 27752, H. T. LUMBSCH & H. STREIMANN (CANB)*. - Robin Falls, 13 km SSE of Adelaide River, sandstone boulders, 13°21'S / 131°08'E, 80 m, 24.3.1986, G. RAMBOLD 5145 (M). - **Queensland**: Port Douglas NE of Cairns, SE end of Island Point, rock outcrops near the shore, 16°28'S / 145°28'E, 20 m, 7.8.1993, H. MAYRHOFFER 11365 & E. HIERZER (BRI, GZU). - Main Range, Baldy Mountain State Forest, Atherton - Herberton Road ca. 6 km NE of Herberton, metamorphic rock outcrops, 17°20'S / 145°26'E, 900 m, 9.8.1993, H. MAYRHOFFER 11323 (GZU). - Main Range, Carr Creek between Mareeba and Mount Molloy, shirt outcrops, 16°50'S / 145°22,5'E, 420 m, 14.8.1993, H. MAYRHOFFER 11356 & E. HIERZER (BRI, CANB, GZU, M, UPS). - Trinity Beach NE of Cairns, SE of Taylor Point, granite boulders, 16°47'S / 145°42,5'E, 10 m, 7.8.1993, H. MAYRHOFFER 11820 & E. HIERZER (GZU).



Fig. 10: Distribution of *Dimelaena elevata*.

3. *Dimelaena oreina* (ACH.) NORM.

NORMAN, *Nyt. Mag. Naturvidensk.* 7: 231 (1852)

Type: Switzerland. 'in albus Helvetiae', SCHLEICHER (H-ACH 1018A - lectotype, non vidimus; compare SHEARD & AHTI 1975).

Description: Thallus thick or thin, yellowish due to usnic acid in the cortex, colour sometimes occluded by an outer epinecral layer or a pruina of oxalate crystals (or both), areolate at centre and radiate-plicate at margin, often delimited by a dark, narrow prothallus. Apothecia 0.2 - 0.9 mm diam., lecanorine, innate or more usually adnate, frequent but rarely contiguous. Disc black or sometimes white-pruinose, plane to slightly convex. Hymenium 60 - 90 μ m tall, paraphyses 2 - 3 μ m wide, apices to 3 - 6 μ m thick, pigmented brown, forming a dark brown epihymenium. Hypothecium to 200 μ m deep, hyaline. Ascospores (fig. 4) 9 - 13 x 5 - 7 μ m, becoming constricted centrally. Spermatogonia immersed, pyriform. Spermatia (fig. 4) bacilliform, 5 - 6 x 1 μ m (3.5 - 5 x 1 μ m according to SHEARD 1974).

Chemistry: Six chemotypes (tab. 2), but only the chemotype II is present in the area studied. Spot tests for chemotype II: K-, C+ red, P-.

Tab. 2: Major products of the chemotypes of *Dimelaena oreina*

chemotype	I	II	III	IV	V	VI
usnic acid	+	+	+	+	+	+
gyrophoric acid		+		+		(+)
fumarprotocetraric acid	+			+		
stictic acid					+	
sphaerophorin						+

Distribution: *Dimelaena oreina* is a widespread lichen in the holarctic. The chemotype II is the most widely distributed in the northern hemisphere and is also known from mountainous areas in South Africa and from South America (fig. 11). The specimens from Tierra del Fuego in South America (CENGIA SAMBO 1927) and from Paarlberg in South Africa (DRÈGE 1843, DOIDGE 1950) were not available for examination.

Ecology: *D. oreina* occurs on steeply inclined surfaces of hard siliceous rocks.

Discussion: *D. oreina* is characterized primarily by the presence of usnic acid, giving the thallus a yellowish colour which was first reported by ZOPF (1907). It is further noteworthy for its chemical variation which has been reported earlier for specimens from Greenland (LYNGE 1937), Sweden (DEGELIUS 1943), Europe and North America (MAGNUSSON 1944), based upon simple thallus spot tests. Later studies focused on the identification of secondary products of the six known chemotypes (tab. 2) and on correlations of chemistry with geography and ecology (HALE 1952, 1954, WETMORE 1968, BRODO 1968, HUNECK & FOLLMANN 1970, SHEARD 1974, SHEARD & AHTI 1975, LEUCKERT & al. 1975, SHEARD 1977, LEUCKERT & POELT 1978, LEUCKERT & al. 1981, CULBERSON & al. 1984, LEUCKERT & al. 1987).

All the specimens examined from the southern hemisphere are referable to chemotype II, with usnic and gyrophoric acids as the main chemical constituents accompanied by lecanoric and ovoic acids as minor compounds.

Specimens examined: AFRICA: Republic of South Africa: **Cape Province:** Queenstown, Brosterlea, Stormberg Mountains, Penhoek Pass between Queenstown and Jamestown, Farm Pen Hoek 181, 1800 m, 2.3.1988, F. BRUSSE 5128 (GZU, PRE). - **Natal:** Mount Currie District, 7 km from Mariazell Mission turn-off to Ongeluksnek, 1700 m, 31.12.1986, F. BRUSSE (BM, PRE). - 18 km NW of Kokstad, Farm Weltevrede, S Krans near Droewig river, 30°8.8'S / 29°8.1'E, 1480 m, 1.1.1978, F. BRUSSE 1170 (PRE). - **Orange Free State:** Golden Gate Highlands National Park, trail Glen Reenen-Bandweg below Wodehouse Kop, shortly before Brandweg, 28°32'S / 28°38'E, 2050 m, 8.3.1990, D. TRIEBEL & G. RAMBOLD 6710, 6716 (M). - **Transvaal:** Johannesburg, Witwatersrand, Gilloolys Hill, 1750 - 1780 m, 15.5.1976, F.

BRUSSE 1128 (GZU, PRE). - Lydenburg, Draaikraal, about 300 m from the Draaikraal turn-off to Roossenekal, on the Lydenburg - Roossenekal Road, Farm Draaikraal 48 KT, 1800 m, 3.6.1990, F. BRUSSE 5776 (GZU, PRE).

SOUTH AMERICA: Argentina: **Prov. Catamarca**: along route 42 near Sierra de Ancasti, 2000 m, 3.6.1989, T. H. NASH 28114 (ASU). - **Prov. Cordoba**: Partido de Punilla, (San Alberta), 1 km W of Copina, 1200 m, 31°35'S / 64°41'W, 12.10.1985, T. H. NASH 24016 (ASU). - Partido de Cruz del Eje, 27 km W of El Durazno, along route 20 at Rio Yuspe crossing, 1500 m, 31°23'S / 64°46'W, 11.10.1985, T. H. NASH 23986 (ASU).

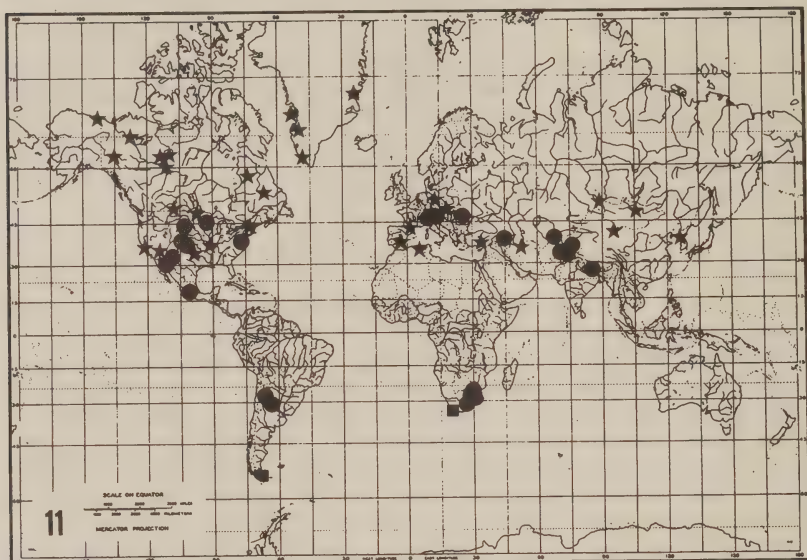


Fig. 11: Distribution of chemotype II of *Dimelaena oreina*:

● specimens examined; ★ according to LEUCKERT & al. (1975, 1987), SHEARD & AHTI (1975) and SHEARD (1977); ■ additional records of *D. oreina* from the southern hemisphere with no further information on their chemistry

4. *Dimelaena tenuis* (MÜLL. ARG.) H. MAYRHOFFER & WIPPEL comb. nov.

Bas. *Catolechia tenuis* MÜLL. ARG., Flora 64: 510 (1881). - Type: Brazil: Faxina, 6.1880, PUIGGARI 1200 (G - lectotype, designated here); same locality, PUIGGARI 1211 (G - isotype).

Rinodina diffractella MÜLL. ARG., Bull. Herb. Boissier 3: 634 (1895). = *Dimelaena diffractella* (MÜLL. ARG.) SHEARD, Bryologist 77: 139 (1974). - Type: Australia: Queensland, 1893, J. SHIRLEY 1908 (G - holotype).

Rinodina muelleri ('mülleri') MALME, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 28(III/1): 21 (1902). This name was introduced by MALME (1902) because a simple combination in *Rinodina* was not possible owing to the existence of *Rinodina tenuis* MÜLL. ARG. (MÜLLER ARGOVIENSIS 1892: 195).

Rinodina physciaeformis MALME, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 28(III/1): 22 (1902). - Type: Brazil: Matto Grosso, Santo Antonio, Morrinho, 21.12.1893, G. O. MALME 2166 (S - holotype).

Dimelaena somaliensis ALSTRUP & al. in ALSTRUP & APTROOT, Cryptogamie, Bryol., Lichénol. 15: 206 (1994). - Type: Somalia: Buur Hakaba, insel mountain N of road, 2°47'N / 44°05', 18.6.1987, V. ALSTRUP 79-5 (C - holotype).

Exs.: KALB: Lich. Neotrop. 221 (BM, GZU, M, hb. Kalb).

Description: Thallus (fig. 7) thin, light or dark brown, smooth and glossy, areolate and radiate plicate at margin with rather long lobes. Apothecia 0.1 - 0.4 mm diam., adnate, frequent, lecanorine at first, becoming biatorine to lecideine. Disc black, plane to slightly convex. Hymenium 50 - 80 µm tall. Paraphyses 1.5 - 2.0 µm wide, apices expanded to 3.5 - 4.5 µm, pigmented brown and forming a dark brown epihymenium. Hypothecium to 100 µm deep, hyaline to light brown. Ascospores (fig. 5) 9 - 14 x 4.5 - 8 µm, nonseptate ascospores rarely present. Spermatogonia immersed, globose. Spermatia (fig. 5) bacilliform, 5 - 8 x 1 µm.

Chemistry: Gyrophoric acid (major), 5-O-methylthiascic acid (major); lecanoric acid (minor), ovoic acid (minor). Spot tests: Medulla: K-, C+ rose, P-.

Distribution (figs 9 and 12): *Dimelaena tenuis* is apparently restricted to subtropical and tropical regions. It was known previously from only one collection from Australia (MÜLLER ARGOVIENSIS 1895, as *Rinodina diffractella*; SHEARD 1974 and MAYRHOFFER 1984, as *Dimelaena d.*), from a few localities in Brazil (MALME 1902, as *Rinodina muelleri* and *R. physciaeformis*; SHEARD 1974 and KALB 1983, as *Dimelaena diffractella*), and from Somalia (ALSTRUP & APTROOT 1994, as *Dimelaena somaliensis*). Here the species is reported for the first time from Venezuela and Colombia in South America, South Africa, the Northern Territory in Australia, New Caledonia and Papua New Guinea. Additional records are provided from Brazil and from Queensland in Australia.

Ecology: In Australia *D. tenuis* occurs on more or less horizontal to slightly inclined surfaces of massive boulders in savannahs or open dry sclerophyll forests.

Discussion: *D. tenuis* is especially characterized by its brown and glossy effigurate thallus with long radiate-plicate lobes. It is well separated from *D. australiensis* by its cylindrical-ellipsoid ascospores, darker thalli, different chemistry, distribution patterns and ecology. Whereas *D. australiensis* is a distinctly temperate species, only reaching the southernmost parts of Queensland near Stanthorpe in Australia, *D. tenuis* is a tropical-subtropical species with its southernmost records in southern Queensland. In contrast to *D. tenuis*, *D. australiensis* occurs mainly on overhanging or steeply inclined rock faces.

Additional specimens examined: AFRICA: Republic of South Africa: **Natal:** Oribi Gorge Nature Reserve, Baboons View NW of Huttet Camp, 30°44'S / 30°16'E, 450 m, 21.3.1990, D. TRIEBEL & G. RAMBOLD 7272 (M).

ASIA: **Papua New Guinea:** National Capital District: Rea-Rea Road, 17 km NW of Port Moresby, 9°23'S / 147°03'W, 30 m, 15.2.1981, H. STREIMANN 16370 & E. K. NAONI (CANB).

AUSTRALIA: **Northern Territory:** Baroalba Creek, 16 km SSE of Jabiru airfield, on boulders in deep gorge, 12°49'S / 132°55'E, 200 m, 21.4.1989, H. STREIMANN 42337 (B, CANB). - Baroalba Creek, 15 km SSE of Jabiru airfield, on exposed rock in small narrow gorge, 12°48'S / 132°55'E, 200 m, 22.4.1989, H. STREIMANN 42359 (B, CANB). - Arnhem Land, 19 km ENE of Jabiru, 12°37'S / 133°03'E, 140 m, 18.4.1989, H. STREIMANN (B, CANB). - Head of Little Horse Creek, Newcastle Range, 8 km SSW of Timber Creek, 200 m, 15°43'S / 130°27'E, 11.4.1989, H. STREIMANN 42000 (CANB). - Wangi Road, Finnis Range, 69 km SSW of Darwin, 13°05'S / 130°42'E, 120 m, 1.1.1985, H. STREIMANN 8796 (CANB). - Ca. 75 km SSW of Darwin, Pethrick's rainforest park (= Woolaning), ca. 110 m, 13°07'S / 130°40'E, 5.12.1985, G. THOR 5901 (S). - Curtain Falls, Litchfield Park, 38 km WSW of Batchelor, 13°08'S / 130°40'E, 60 m, 3.7.1991, J. A. ELIX 27605, 27609, 27611, H. T. LUMBSCH & H. STREIMANN (CANB). - **Queensland:** Glass House Mountains, N-facing hills S of Tibrogargan Mtn., 26°57'S / 152°57'E, 100 m, 19.8.1986, J. HAFELLNER 15566 (GZU). - Same locality, J. HAFELLNER 15679 (hb. Hafellner). - Beerwah, Glass House Mountains National Park, Mt. Tibrogagan N of Beerburum, above picnic area W of Mt. T., rhyolite boulders, 26°55'S / 152°56.5'E, 50 - 80 m, 20.8.1993, H. MAYRHOFFER 11608, E. HIERZER, N. & N. STEVENS (ASU, BRI, GZU, M, UPS). - Beaudesert, ca. 10 km W of Rathdowney, Mt. Barney National Park, Yellow Pinch, ca. 300 - 400 m, 29.8.1992, A. WIPPEL (BRI, CANB, GZU, HO, M, WELT). - Beaudesert, Mt. Barney National Park, East Peak, ca. 900 m, 12.9.1992, A. WIPPEL (BRI, CANB, GZU, HO, M, MEL, WELT). - Boonah, ca. 27 km W of Rathdowney, Mt. Maroon National Park, Cotswold Road, ca. 400 - 700 m, 5.9.1992, A. WIPPEL (BRI, GZU). - Mt. Tinbeerwah W of Tewantin, ENE of Cooroy, massive rhyolite outcrops close to the summit, 26°23'S / 152°58'E, 250 m, 20.8.1993, H. MAYRHOFFER 11658, E. HIERZER, N. & N. STEVENS (GZU). - Eungella National Park, NW of Mackay, Mt. Dalrymple, 21°02'S / 148°38'E, 1240 m, 20.2.1986, G. RAMBOLD (M). - Bruce Highway, 46 km NW of Townsville, 19°05'S / 146°35'E, 30 m, 18.6.1984, H. STREIMANN 28290 (B, CANB). - Tumoulin State Forest, 6 km N of Ravenshoe, on exposed flat rocky

area, 17°33'S / 145°28'E, 1040 m, 16.12.1990, H. STREIMANN 46638 (B, CANB). - Main Range, Baldy Mountain State Forest, Atherton - Herberton Road ca. 6 km NE Herberton, metamorphic rock outcrops, 17°20'S / 145°26'E, 900 m, 9.8.1993, H. MAYRHOFFER 11317 (BRI, GZU, M). - Main Range, Watsonville on the Herberton - Petford Road ca. 10 km W of Herberton, granite boulders, 17°12'S / 145°19'E; 860 m, 9.8.1993, H. MAYRHOFFER 11888 (GZU). - Port Douglas NE of Cairns, SE end of Island Point, 16°28'S / 145°28'E, 20 m, 7.8.1993, H. MAYRHOFFER 11366 & E. HIERZER (GZU). - Lamb Range, Davies Creek National Park E of Mareeba, Davies Creek Falls, picnic area above the falls, granite boulders along the creek, 17°01'S / 145°35'E, 600 m, 11.8.1993, H. MAYRHOFFER 11435 & E. HIERZER (BRI, CANB, GZU, M). - Atherton Tableland, Granite Gorge SW of Mareeba, granite boulders along the creek, 17°01'S / 145°21'E, 500 m, 9.8.1993, H. MAYRHOFFER 11765 & E. HIERZER (GZU).

New Caledonia: **Province Nord**: West coast, Col de Crève-Coeur, between Ouégoa and Koumac, 20°26'S / 164°23'E, 200 m, 30.8.1994, A. & K. KALB 27424 (hb. Kalb).

SOUTH AMERICA: Brazil: **Bahia**: Chapada Diamantina, Serra do Tombador, ca. 1 km E of Morro do Chapéu, 1000 m, 19.7.1980, K. KALB (KALB: Lich. Neotrop. 221). - Serra do Tombador, between Mundo Novo and Morro do Chapéu, 1000 m, 18.-20.7.1980, K. KALB 9336, 10737 (hb. Kalb). - **Matto Grosso**: Santo Antonio, Morro Grande, 20.12.1893, G. O. MALME 2131 (S). - Santo Antonia, Morrinho, 25.4.1894, G. O. MALME 2617 (S). - **Rio Grande do Sul**: Porto Alegre, Parthenows, 15.10.1892, G. O. MALME 577 (S). - Porto Alegre, 2.6.1893, G. O. MALME 1337 (S). - **São Paulo**: Serra Taquari, Itirapina, ca. 50 km SW of Piraçununga, 550 m, 16.6.1979, K. KALB 9540 (hb. Kalb). - Apiahy, 1880, Puiggari (G). - Ad flumen Iguape prope Iporanga, 1888, PUIGGARI 1211, 1224 (G).

Colombia: **Comisaría Amazonas**: Araracuara, tableland on S-side of river Caquetá W of Puerto Santander, opposite airstrip of Araracuara, sandstone plates with low savanna forest, 0°36'S / 72°25'W, 350 m, 30.10.1988, H. SIPMAN 27873 & J. DUIVENVOORDEN (B).

Venezuela: **Estado Merida**: El Valle N Merida, ca. 2850 m, 3.1969, B. OBERWINKLER, F. OBERWINKLER & J. POELT (GZU).

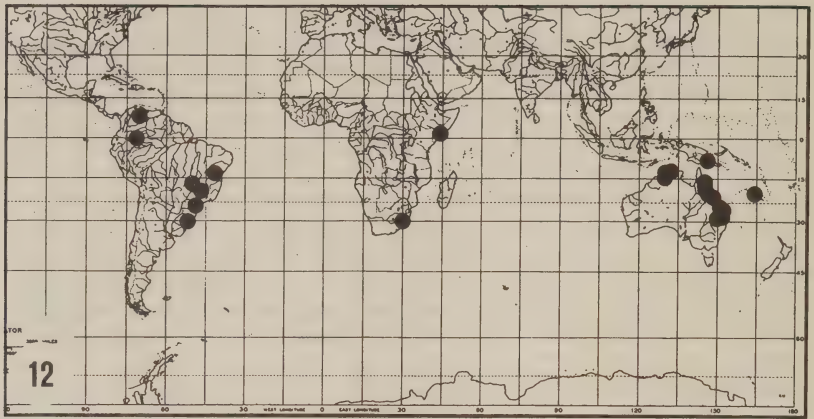


Fig. 12: Distribution of *Dimelaena tenuis*.

ACKNOWLEDGEMENTS

We thank the curators of the following herbaria for the loan of specimens: ASU, B, BM, C, CANB, G, GZU, M, PRE, S, as well as Dr Josef HAFELLNER (Graz) and Dr Klaus KALB (Neumarkt/OPf.) for specimens from their personal herbaria. We thank Prof. Dr Josef POELT (Graz) for correcting the Latin diagnosis, Prof. Dr John W. SHEARD (Saskatoon) and Dr Gintaras KANTVILAS (Hobart) for stimulating discussions, Mr John WILLIAMS (Armidale) and Drs Nell and Neville STEVENS (Brisbane) for their generous support during field trips. The support of the 'Fonds zur Förderung der wissenschaftlichen Forschung' (projects P8500-BIO and P10514-BIO) is acknowledged by H. M. and M. M. Field studies in Queensland (H. M.) were made possible by an exchange programme between the University of Queensland and the Karl-Franzens-Universität Graz and for A. W. in Queensland and New South Wales by a grant from the Austrian 'Bundesministerium für Wissenschaft und Forschung'. J. A. E. thanks the Australian Research Council for generous financial support.

REFERENCES

- ALSTRUP, V. & APTROOT, A. 1994: *Dimelaena somaliensis* sp. nov. with notes on lichens from Somalia. - *Cryptogamie, Bryol., Lichénol.* 15: 205 - 209.
- BRODO, I. M. 1968: The lichens of Long Island, New York: A vegetational and floristic analysis. - *New York State Museum Science Service Bull.* 410: I - X, 1 - 330.
- CENGIA SAMBO, M. 1927: I licheni della Terra del Fuoco raccolti dai Missionari Salesiani. - Torino.
- CULBERSON, C. F. & AMMANN, K. 1979: Standardmethode zur Dünnschicht-chromatographie von Flechtensubstanzen. - *Herzogia* 5: 1 - 24.

- CULBERSON, C. F. & JOHNSON, A. 1982: Substitution of methyl tert.-butyl ether for diethyl ether in the standardized thin-layer chromatographic method of lichen products. - J. Chromatogr. 238: 483 - 487.
- CULBERSON, C. F., HALE, M. E., TØNSBERG, T. & JOHNSON, A. 1984: New depsides from the lichens *Dimelaena oreina* and *Fuscidea viridis*. - Mycologia 76: 148 - 160.
- DEGELIUS, G. 1943: Zur Kenntnis der Flechtenflora um See Virihaure in Lule Lappmark (Schwedisch-Lapland). - Bot. Not. 1943: 75 - 113.
- DOIDGE, E. M. 1950: The South African fungi and lichens to the end of 1945. - Bothalia 5: 1 - 1094.
- DRÈGE, J. F. 1843: Zwei pflanzengeographische Documente. - Besondere Beigabe zur Flora 2: 1 - 230.
- ELIX, J. A. & BENNETT, S. A. 1990: 6-O-Methylarthothelin and 1,3,6-tri-O-methylarthothelin, two new xanthenes from a *Dimelaena* lichen. - Aust. J. Chem. 43: 1587 - 1590.
- ELIX, J. A. & CROOK, C. E. 1992: The joint occurrence of chloroxanthenes in lichens, and a further thirteen new lichen xanthenes. - Bryologist 95: 52 - 64.
- ELIX, J. A., BENNETT, S. A. & JIANG, H. 1991: 2,5-Dichloro-6-O-methylnorlichexanthone and 4,5-dichloro-6-O-methylnorlichexanthone, two new xanthenes from an Australian *Dimelaena* lichen. - Aust. J. Chem. 44: 1157 - 1162.
- FEIGE, G. B., LUMBSCH, H. T., HUNECK, S. & ELIX, J. A. 1993: The identification of lichen products by a standardized high-performance liquid chromatographic method. - J. Chromatogr. 646: 417 - 427.
- HALE, M. E. 1952: Studies on the lichen *Rinodina oreina* in North America. - Bull. Torrey Bot. Club 79: 251 - 259.
- HALE, M. E. 1954: Lichens from Baffin Island. - American Midland Naturalist 51: 232 - 264.
- HALE, M. E. & CULBERSON, W. L. 1970: A fourth checklist of the lichens of the continental United States and Canada. - Bryologist 73: 499 - 543.
- HUNECK, S. & FOLLMANN, G. 1970: Mitteilungen über Flechteninhaltsstoffe LXXV. Zur Phytochemie und Chemotaxonomie der Buelliaceae. - Biochem. Physiol. Pflanzen 161: 191 - 214.
- KALB, K. 1983: Lichenes Neotropici. Fasc. VI (No. 201 - 250). - Neumarkt/OPf.
- LEUCKERT, CH. & MAYRHOFER, H. 1985: Chemische Flechtenanalysen IV. - Herzogia 7: 99 - 104.
- LEUCKERT, CH. & POELT, J. 1978: Über Nord-Süd-Gradienten von Chemotypen europäischer Flechten. - Pl. Syst. Evol. 130: 53 - 77.
- LEUCKERT, CH., BUSCHARDT, A. & HERTEL, H. 1981: Die Verteilung der Chemotypen von *Dimelaena oreina* (Lichenes) auf verschiedene Höhenstufen

an einem Transekt im Vinschgau (Südtirol, Italien). - Nova Hedwigia 34: 623 - 632.

LEUCKERT, CH., SCHIRRMUSTER, M. & STEEN HANSEN, E. 1987: Chemo-systematical investigation of lichens from Greenland. *Dimelaena oreina* (Ach.) Norm. - Bot. Jahrb. Syst. 108: 373 - 379.

LEUCKERT, CH., SUDASZEWSKI, U. & HERTEL, H. 1975: Chemische Rassen bei *Dimelaena oreina* (Ach.) Norm. unter besonderer Berücksichtigung der Verhältnisse in Mitteleuropa (Lichenes, Physciaceae). - Bot. Jahrb. Syst. 96: 238 - 255.

LYNGE, B. 1937: Lichens from West Greenland, collected chiefly by Th. M. FRIES. - Meddel. om Grønland 118: 1 - 225.

MAGNUSSON, A. H. 1944: Lichens from central Asia. Part II. - Reports from the scientific expedition to the north-western provinces of China under the leadership of Dr. Sven HEDIN. The Sino-Swedish Expedition. Publication 22, XI. Botany 2: 1 - 68, 8 plates.

MALME, G. O. 1902: Die Flechten der ersten Regnell'schen Expedition. II. Die Gattung *Rinodina* (Ach.) Stiz. - Bih. Kongl. Svenska Vetensk.-Akad. Handl. 28(III/1): 1 - 53.

MAYRHOFFER, H. 1984: The saxicolous species of *Dimelaena*, *Rinodina* and *Rinodinella* in Australia. - In HERTEL, H. & OBERWINKLER, F., (eds): Festschrift J. Poelt. - Beih. Nova Hedwigia 79: 511 - 536.

MAYRHOFFER, H., WIPPEL, A., MATZER, M. & ELIX, J. A. 1994: The genus *Dimelaena* (lichenized Ascomycetes, Physciaceae) in the southern hemisphere. - Fifth International Mycological Congress Abstracts: 136. - Vancouver, British Columbia.

MÜLLER [ARGOVIENSIS], J. 1892: Lichenes Yatabeani, in Japonia lecti et a Cl. Prof. YATABE missi. - Nuovo Giorn. Bot. Ital. 24: 189 - 202.

MÜLLER [ARGOVIENSIS], J. 1895: *Lecanoreae* et *Lecideae* Australienses novae. - Bull. Herb. Boissier 3: 632 - 642.

POELT, J. 1969: Bestimmungsschlüssel europäischer Flechten. - Lehre.

RAMBOLD, G., MAYRHOFFER, H. & MATZER, M. 1994: On the ascus types in the Physciaceae (Lecanorales). - Pl. Syst. Evol. 192: 31 - 40.

SHEARD, J. W. 1974: The genus *Dimelaena* in North America north of Mexico. - Bryologist 77: 128 - 141.

SHEARD, J. W. 1977: Paleogeography, chemistry and taxonomy of the lichenized Ascomycetes *Dimelaena* and *Thamnolia*. - Bryologist 80: 100 - 118.

SHEARD, J. W. & AHTI, T. 1975: The lichen *Dimelaena oreina* in east-central Asia, with notes on its typification and chemical races. - Ann. Bot. Fenn. 12: 89 - 92.

SHEARD, J. W. & MAYRHOFFER, H. 1984: Two new species of the lichenized Ascomycete genus *Dimelaena* Norm. - Bryologist 87: 246 - 248.

VEZDA, A. 1994: Lichenes rariores exsiccati. Fas. XIV (n. 131 - 140). - Brno.

WETMORE, C. M. 1968: Lichens of the Black Hills of South Dakota and Wyoming. - Publ. Mich. State Univ. Mus. Biol. Ser. 3: 209 - 464.

ZAHLEBRUCKNER, A. 1926: Lichenes (Flechten). - In: ENGLER, A. & PRANTL, K. Die natürlichen Pflanzenfamilien, 2. Aufl., Band 8: 61 - 270. - Leipzig.

ZOPF, A. 1907: Die Flechtenstoffe. - Jena.

PERONOSPORA ON ACAENA (ROSACEAE)

O. Constantinescu

Botanical Museum, Uppsala University, Villavägen 6, S-753 36 Uppsala, Sweden

Abstract. Following the examination of additional specimens, the rare *Peronospora* parasitic on *Acaena* is described, illustrated, and ascribed to *Peronospora sparsa*.

Palm (1908) recorded the occurrence of *Peronospora potentillae* de Bary (*Oomycota*, *Peronosporales*) on a new host, *Acaena magellanica* (Lam.) Vahl (= *A. laevigata* (Lam.) Aiton), a rosaceous plant cultivated in the Bergius Botanic Garden, Stockholm. Gäumann (1923), who did not examine the specimen, considered this finding extremely interesting because of the unusual host and geographical location. Gustavsson (1959) provided a description based on Palm's specimen deposited in herb. S, but could not decide if this was a new species of *Peronospora* or not. Brandenburger (1985) mentioned this fungus as *Peronospora* sp., including some morphological details taken from Gustavsson (1959). In a revision of *Peronospora* parasitic on *Rosaceae* in central Europe, Skalický (1983) was ambivalent about the taxonomy of this fungus. He stated that it should be described as a new species (page 77), but that it is not possible to decide if it is an independent species (page 83), and eventually called it *Peronospora* sp. (page 84).

A new specimen of *Peronospora* on *Acaena ovalifolia* Ruiz & Pavón, collected in 1994 from Argentina, became available through the courtesy of Dr. Maria Havrylenko de Saura. Two more specimens were found when the herbarium material of *Acaena* in herb. UPS was inspected in search for *Peronospora* presence.

As a consequence of additional material becoming available, an attempt to elucidate the taxonomic position of *Peronospora* on *Acaena* was undertaken.

Herbaria are abbreviated according to Holmgren *et al.* (1990), and for statistical analysis the computer program InStat (GraphPad Software, 1993) was used.

Description of the specimens

On the upper surface of attacked leaves, the tissues invaded by the fungus show symptoms ranging from slightly discoloured areas, to numerous, reddish-brown, vein-limited, discrete or coalesced spots.

The *down* is hypophyllous, often hardly visible, ochre, and consists of conidiophores, either solitary or aggregated in patches. *Conidiophores* slender, more or less straight, 250–1000 μm ; basal vesicle slightly bulbous, up to 13 μm wide; trunk 150–570 μm , of more or less uniform width, 5–11 μm at the base, 5–10 μm wide below the first branch; branches flexuous, dichotomously divided 3–6 times, ultimate

branchlets up to 23 μm long, tip flattened to round; *spores* when young almost globose, later broadly ellipsoidal, pale yellow, (19–) 20.6 ± 1.05 (–23) μm long, (16–) 17.7 ± 0.99 (–20) μm wide, length/breadth ratio (1.1–) 1.2 ± 0.05 (–1.37) ($n=45$), broadest part median, rarely supra-median, wall *ca* 0.5 μm thick, verruculose, pedicel hardly visible to slightly protruding. *Sexual organs* not found.

On *Acaena magellanica* (Lam.) Vahl, cult., Sweden, Uppland, Stockholm, Bergielund, Oct. 1907, B. Palm (S); *A. ovalifolia* Ruiz & Pavón, Argentina, Prov. Rio Negro, depto Bariloche, near lake Nahuel Huapi, 9 Feb. 1994, coll. Maria Havrylenko de Saura, no 231 (UPS); *A. elongata* L., Ecuador, Carchi Prov., between El Pun and Tulcan, Nov. 1952, coll. F. Fagerlind & G. Wibom no 1408 (UPS, part of the specimen in the phanerogamic herbarium); *A. sanguisorbae* Vahl, cult., Germany, Bremen, Botanical Garden, *sine dat.*, G. Bitter (UPS, part of the specimen in the phanerogamic herbarium).

Discussion

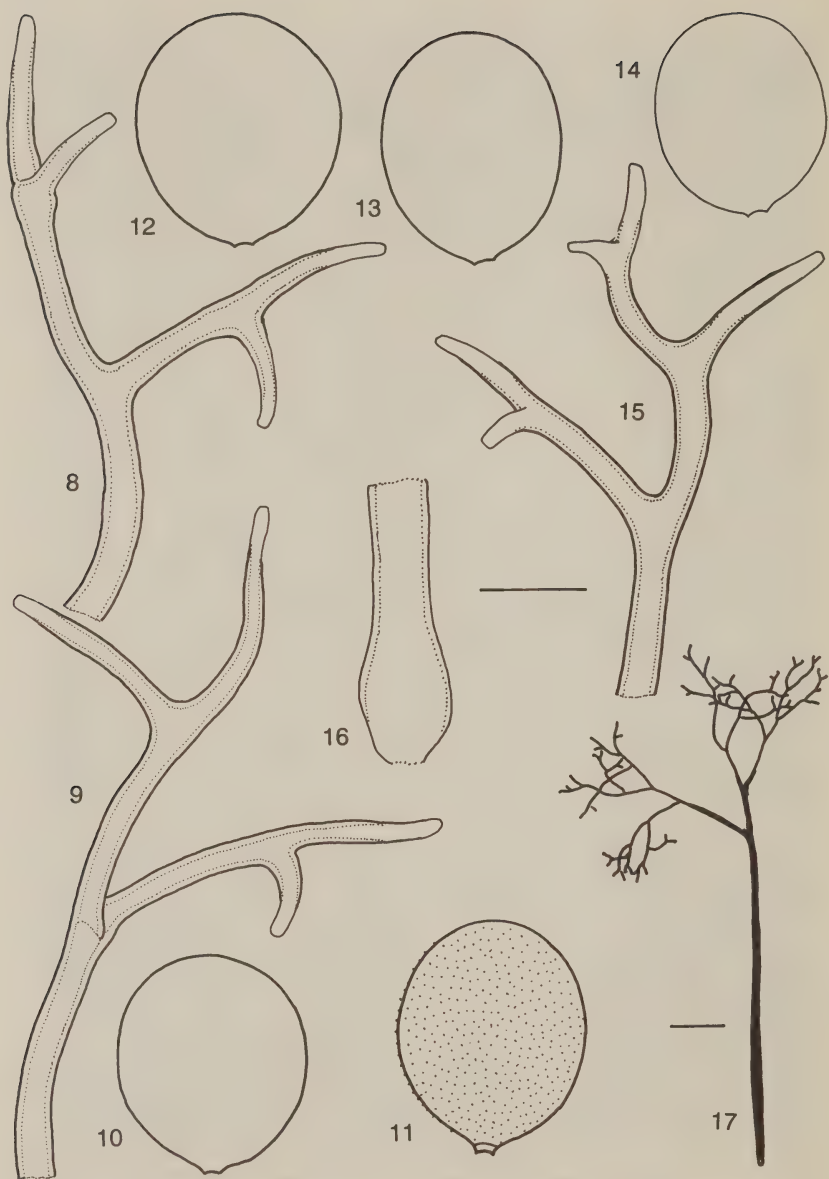
The fungi present on the four specimens of *Acaena* are morphologically very similar. They show the same type of straight, slender conidiophores, and identical branching pattern. In all samples the wall of spores has a verruculose surface, that is visible even in DIC light (Figs 6 and 7). The means of the length and breadth, as well as the L/B ratio of the spores originating from the four specimens, were compared to each other by applying the unpaired *t* test, but were not significantly different.

Thirteen species and one variety of *Peronospora* described on various *Rosaceae* are listed by Constantinescu (1991). Skalický (1983) recognized 9 taxa on this family of plants. He divided these taxa into two groups, those parasitic on hosts belonging to subfam. *Agrimonioidae* (*P. agrimoniae* H. Sydow, *P. alchemillae* Oth., and *P. sanguisorbae* Gäum.), and those parasitic on hosts of subfam. *Rosoideae* (*P. gei* H. Sydow, *P. potentillae* de Bary, *P. fragariae* Roze & Cornu, *P. potentillae-reptantis* Gäum., *P. rubi* Rabenh. ex Schröter, and *P. sparsa* Berk.). In addition, he provided two keys for the identification of these species, one for each subfamily of hosts. He did not explain the rationale behind this partition, but it is obvious that he considered the subfamily rank as a taxonomic boundary for both the hosts, and the fungi. However, in the standard flora of Europe (Valentine & Chater, 1968), all hosts involved are treated as members of subfam. *Rosoideae*, and the subfam. *Agrimonioidae* is not recognized. Skalický's species concept combines an ecological aspect (each species of *Peronospora* is considered as being confined to one genus of host, or in some cases to only one or a few species), and a phenetic one (morphology of the conidiophores and biometry of the spores).

The species of *Peronospora* parasitic on *Rosaceae* can be divided into two discrete units. First, species having ellipsoidal to obovate-ellipsoidal spores (L/B ratio >1.40), mostly longer than 23 μm . Here belongs only *P. potentillae*, parasitic on several but not all species of *Potentilla* (see Skalický (1983) and Hall (1991)). Second, species having subglobose to broadly ellipsoidal spores (L/B ratio <1.35), mostly shorter than 22 μm . All other *Peronospora* species parasitic on various genera of *Rosaceae* belong here, the oldest epithet available being *P. sparsa* Berk. The shape and size of spores in these species form a continuum. Some of them may deserve specific rank, but such a decision is hindered, among other, by the paucity of both the spores and sexual organs in most available specimens.



Figs 1-7. *Peronospora sparsa* on *Acaena*. Conidiophores and spores. Spore ornamentation as seen in face (arrowheads) and lateral (arrow) view. Figs 1 & 5 from *A. ovalifolia*; 2-4, 6 & 7 from *A. magellanica*. Bar = 20 μ m for 1 & 2; 10 μ m for 3-7.



Figs 8–17. *Peronospora sparsa* on *Acaena*. Figs 8, 9 & 15, ultimate branchlets; 16, conidiophore base; 17, conidiophore habit; 10–14, spores. Figs 8–11 & 16 from *A. ovalifolia*; 12–15, 17 from *A. magellanica*. Bar = 10 μm for 8–16; 20 μm for 17.

Peronospora on *Acaena* cannot be distinguished from *P. sparsa* Berk., the common, world wide parasite of cultivated roses (Francis, 1981). It has a similar, overall morphology of the conidiophores, and the same shape and size of spores. In addition, the ornamentation of spores, first depicted in *P. sparsa* by Hall (1992), is also similar.

Most students of the *Peronosporaceae* consider *P. sparsa* restricted to *Rosa* (Gäumann, 1923; Kochman & Majewski, 1970; Francis, 1981; Skalický, 1983). This narrow host specificity is not supported by experimental evidence, but is based more on the unsubstantiated practice of considering fungi parasitic on cultivated and wild plants as different taxa.

Most species of *Peronospora* have been discovered and described from wild plants. When a morphologically similar fungus was found on a cultivated plant, belonging to the same family, a new name was often introduced for the fungus parasitic on the cultivated host. In most cases, however, the two taxa were eventually considered conspecific. Thus, *Peronospora* parasitic on tobacco was described as *P. tabacina* Adam (1933), and this name was in use until Shepherd (1970) proved that *P. tabacina* is only a specialized form of *P. hysocyami* de Bary, a species widely spread on *Solanaceae*. *Peronospora* parasitic on sugar beet was described in 1865 as *P. schachtii* Fuckel. The name was used by both mycologists and phytopathologists until Byford (1967) showed that this fungus is conspecific with *P. farinosa* (Fr. : Fr.) Fr., the common *Peronospora* of many *Chenopodiaceae*.

Peronospora on *Rosaceae* is an example of a completely different situation. The first *Peronospora* parasitic on *Rosaceae* was described on cultivated roses, in 1862, as *P. sparsa* Berk. Subsequently, 13 more *Peronospora* taxa were described, mostly on wild *Rosaceae*. Although many of these taxa are indistinguishable from *P. sparsa*, they were treated as distinct taxa in major publications on the *Peronosporaceae* (Gäumann, 1923; Gustavsson, 1959; Kochman & Majewski, 1970; Skalický, 1983). Nevertheless, Constantinescu & Negrean (1983) considered that *P. sparsa* is parasitic, beside *Rosa*, on seven other genera of *Rosaceae*, and Hall *et al.* (1992) assigned a *Peronospora* found on cultivated *Prunus laurocerasus* L. (a member of subfam. *Prunoideae*) also to *P. sparsa*. Moreover, recent *in vitro* studies by Breese *et al.* (1994) demonstrated that *P. sparsa* and *P. rubi* originating from cultivars of *Rosa* and *Rubus* are not host specific.

There is little doubt that the cultivated roses are only occasional hosts of *P. sparsa*, that this fungus is more common on wild *Rosaceae*, and that it originates from these plants. The specimens of *Acaena* examined in this study have been collected from South America and Europe where the presence of *P. sparsa* is documented (Francis, 1981). Because the rôle of wild hosts in the epidemiology of diseases produced by *Peronosporales* was questioned (Renfro & Bhat, 1981), confusion concerning the origin and inferred systematics of these fungi often arose. The fact that, in some cases, the results of cross-inoculations attempts with parasitic fungi to and from wild and cultivated hosts is negative does not mean that two fungi are involved. The fungi living on cultivated plants have evolved and specialized on these hosts and they may not be capable to contaminate *now*, related, wild plants. Similarly, the fungi parasitic on wild hosts may not show *now* affinity for a related cultivated plant. In both cases the fungi are physiologically different *at the time of the experiment*. This is not necessarily evidence of different genetic origin and implicit taxonomic dissimilarity.

Acknowledgments. I am indebted to Dr Maria Havrylenko de Saura for the permission to investigate the specimen collected by her, to Dr. Uwe Braun for putting this specimen at my disposal, to the Directors and Curators of herb. S and UPS for permission to examine specimens in their keeping, to Dr Geoffrey Hall for critical comments as a presubmission reviewer, to Mrs Ulla-Britt Sahlström for photographic assistance, and to the Swedish Natural Science Council for financial support within the project BU 06546-303 'Taxonomy and Phylogeny of *Peronosporales*'.

Literature cited

- Adam, B.D. (1933). Blue mould of tobacco. On the morphology of the fungus and its nomenclature. *J. Agric. Vict.* **31**: 412-416.
- Brandenburger, W. (1985). *Parasitische Pilze an Gefäßpflanzen in Europa*. Gustav Fischer: Stuttgart, New York.
- Breese, W.A., Shattock, R.C., Williamson, B. & Hackett, C. (1994). In vitro spore germination and infection of cultivars of *Rubus* and *Rosa* by downy mildews from both hosts. *Ann. appl. Biol.* **125**: 73-85.
- Byford, W.J. (1967). Host specialization of *Peronospora farinosa* on *Beta*, *Spinacia* and *Chenopodium*. *Trans. Br. mycol. Soc.* **50**: 603-607.
- Constantinescu, O. (1991). An annotated list of *Peronospora* names. *Thunbergia* **15**: 1-110.
- Constantinescu, O. & Negrean, G. (1983). Check-list of Romanian *Peronosporales*. *Mycotaxon* **16**: 537-556.
- Francis, S.M. (1981). *Peronospora sparsa*. *CMI Descr. Path. Fungi & Bact.* **690**: 1-2.
- Gäumann, E. (1923). Beiträge zu einer Monographie der Gattung *Peronospora* Corda. *Beitr. Krypt. -Fl. Schweiz* **5(4)**: 1-360.
- GraphPad Software (1993). *InStat. Version 2.04*. GraphPad Software Inc: San Diego.
- Gustavsson, A. (1959). Studies on Nordic *Peronosporas*. I. Taxonomic revision. *Op. bot. Soc. bot. Lund* **3 (1)**: 1-271.
- Hall, G. (1991). *Peronospora potentillae*. *IMI Descr. Path. Fungi & Bact.* **1061**: 1-2.
- Hall, G., Cook, R.T.A. & Bradshaw, N.J. (1992). First record of *Peronospora sparsa* on *Prunus laurocerasus*. *Pl. Path.* **41**: 224-227.
- Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. (1990). *Index Herbariorum. Part I: The Herbaria of the World*. 8th ed. New York Botanical Garden: Bronx.
- Kochman, J. & Majewski, T. (1970). *Grzyby (Mycota). Tom IV. Glonowce (Phycomycetes), Wroślikowe (Peronosporales)*. Państwowe Wydawnictwo Naukowe: Warszawa.
- Palm, B. (1908). Till kännedomen om Stockholmstraktens svampflora. *Svensk bot. Tidskr.* **2**: 38-48.
- Renfro, B.L. & Bhat, S.S. (1981). Role of wild hosts in downy mildew diseases. In *The Downy Mildews*. (ed. Spencer, D.M.), pp. 107-119. Academic Press: London.
- Shepherd, C.J. (1970). Nomenclature of the tobacco blue mould fungus. *Trans. Br. mycol. Soc.* **55**: 253-256.
- Skalický, V. (1983). The revision of species of the genus *Peronospora* on host plants of the family *Rosaceae* with respect to Central European species. *Folia geobot. phytotax. Praha* **18**: 71-101.
- Valentine, D.H. & Chater, A.O. (1968). *Rosaceae*. In *Flora Europaea*. Vol. 2. (eds Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A.), pp. 3-80. Cambridge University Press: Cambridge.

A NEW SPECIES OF MIRIQUIDICA FROM THE COASTAL DESERT IN BAJA CALIFORNIA

by G. Rambold*, H. Sipman** and H. Hertel*

* Botanische Staatssammlung, Menzinger Straße 67, D-80639 München,
Germany

** Botanischer Garten und Botanisches Museum, Königin-Luise-Straße 6-8,
D-14191 Berlin, Germany

Abstract

A new lichen species, *Miriquidica mexicana*, is described from Baja California. Conspicuous features are its glossy, brown, areolate thallus and its black prothallus composed of dendroid-branched strands. It is the first known desert-inhabiting species of this predominantly boreal-montane genus and grows on sites exposed to frequent fog from the Pacific ocean.

Keywords: *Miriquidica*, Lecanorales, lichens, flora of Mexico, coastal desert.

Introduction

The genus *Miriquidica* (Lecanoraceae) is mostly found in boreal-montane and arctic-alpine habitats of Europe (HERTEL & RAMBOLD 1987, RAMBOLD & SCHWAB 1989) and North America (EGAN 1989, THOMSON & WEBER 1992). Here the southern limit is reached by, e.g., *M. deusta*, which is fairly common in the siliceous mountains of the western Mediterranean area and Macronesia (NIMIS 1993). This species and *M. leucophaea* are the only representatives of the genus hitherto recorded from the Southern Hemisphere, from the alpine zone of Australia (RAMBOLD 1989).

The discovery of a species of *Miriquidica* in a subtropical desert therefore is surprising, and suggests a considerable enlargement of the known spec-

trum of ecological conditions in which the genus is found. However, its occurrence in the desert along the Pacific coast in Baja California most probably depends on the cold stream, which influences the coast strongly and causes a cooler climate with frequent fog. This situation may offer growth conditions much more similar to those in boreal-montane environments than usual in deserts. Indeed, the sites in which it is found show a much more luxuriant lichen flora than usual in deserts.

Miriquidica mexicana Rambold, Sipman & Hertel, spec. nov.

Typus: Mexico, Baja California, 23 km SE of El Rosario along Route 1, near Km 78 on road from San Quintín to Parador Punta Prieta, 30°02'N, 115°31'W, alt. 200 m, 5 January 1989, *H. Sipman 24923* (B, holotype) - [containing miriquidic acid, detected by TLC].

Diagnosis: Thallus areolatus, fuscus, nigro-limitatus; areolis rotundis, 0.15–0.9 mm diam., nitidis, plus minusve planis, margine prominente nigro vel albo-pruinoso; prothallo crasso nigro lacerato; medulla non amyloidea, acido miriquidico continente. Apothecia nigra, ad 0.8 mm diam., sessilia, margine nigro prominente, disco plano; hymenio 27–40 μ m alto, hyalino, epithecio viride; excipulo in parte exteriori viridinigrante ad brunneo, in parte interno pallido; ascosporis ellipsoideis, c. 7–10 $\times$ 3.2–4.5 μ m.

Etymology: The epithet "*mexicana*" refers to the country in which the species is found.

Description: Thallus crustose, epilithic, up to 5 cm or more in diam., regularly areolate to dispersed areolate, up to 0.4 mm thick; prothallus conspicuous, black, 0.07–0.12 mm thick, composed of dense, dendroidbranched strands (Fig. 1), projecting 0.5–1 mm beyond the areoles; areoles roundish in outline, initially plane, later convex, sometimes undulate or almost semiglobose, 0.15–0.9 mm in diam., brown when dry, pale yellowish to olive-green when wet, usually shiny, with a prominent, narrow, 0.03 mm wide, blackish, more or less white-pruinose margin; in section with a 5–15 μ m thick epinecral layer, a 3–8 μ m thick brown cortical layer and a c. 10–20 μ m thick unpigmented lower cortical layer; algal cells up to 13 μ m diam.; medullary hyphae 4–5 μ m wide, with thin lumina (0.7–1.0 μ m), not amyloid.

Apothecia sessile, usually distinctly constricted at the base, c. 0.4–0.8 mm in diam., regularly distributed over the thallus, single on the areoles; disc plane at first, finally convex, black (when dry), epruinose; margin usually

prominent, up to 0.07 mm thick, black, commonly slightly glossy, sometimes white-pruinose; excipulum 80–100 μm wide, with ectal zone dark olive in the upper parts and brownish in the lower parts, internally unpigmented and with inspersed crystals of lichen substances (miriquidic acid) and algal cells, composed of 3–4 μm thick hyphae with 2 μm wide lumina and without swollen apices; hypothecium colorless, 70–110 μm high, in its lower part incrustated with crystals of lichen substances; hymenium colorless, 27–40 μm high; hymenial gel $I_{[\text{Lugol } 1:6]}$ – or + bluish; epihymenium dark olive brown to greenish (*Lecidea*-green), 7–12 μm high; paraphyses usually simple, 2.0–2.5 μm wide, with 1–1.5 μm wide lumina, apically 2.5–4.0 μm wide with c. 2 μm wide lumina; asci 30–45 $\times$ 7–12 μm ; amyloid wall layer c. 0.5 μm thick; tholus max. 7–8 μm , min. 5–6 μm high, without or with small ocular chamber, with narrow axial body; ascospores ellipsoid, simple, 6.5–7.8–10 $\times$ 3.2–3.7–4.5 μm , length-width ratio 2.1, mean volume 62–95–192 μm^3 .

Pycnidia immersed, $\pm$ globular, c. 0.1 mm in diam., blackish; pycnospores filiform, 20–27–42 $\times$ c. 0.7 μm ; conidiophores similar to type V of VOBIS (1989).

Chemistry: Miriquidic acid or lobaric acid.

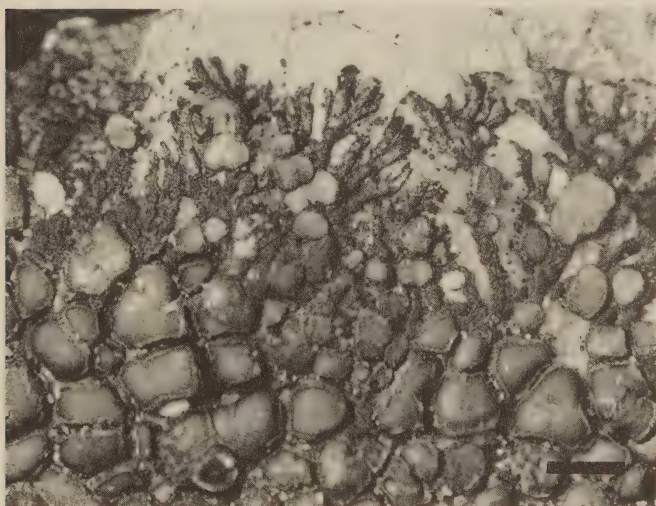


Fig. 1. *Miriquidica mexicana*, marginal part of thallus. Scale: 0.5 mm.

Ecology and distribution: *Miriquidica mexicana* is most likely an endemic species of Baja California. It has been found on stones on the soil in scarce desert scrub on exposed sites at low elevations on the Pacific side of the Baja California Peninsula (Fig. 2). Phytogeographically the collecting localities belong to the northern and southern Vizcaíno Regions of the Sonoran desert. On one label basalt is mentioned as substrate; another collection has grown in part on a quartz band.

Notes. Superficially *M. mexicana* resembles members of the *Lecidea atrobrunnea* group and is characterized by a brown thallus, a hypothallus composed of dendroid-branched strands, sessile apothecia which contain algal cells in their margins, relatively small ascospores, a hyaline hypothecium and the content of miriquidic acid or lobaric acid. The alternative occurrence of these two substances within one and the same species is already known from *Miriquidica deusta*, a similar species which differs by adnate apothecia and much broader ascospores. In habit, *M. mexicana* resembles most *M. garovaglii*, from which it differs by the absence of stictic acid and by the smaller ascospores.

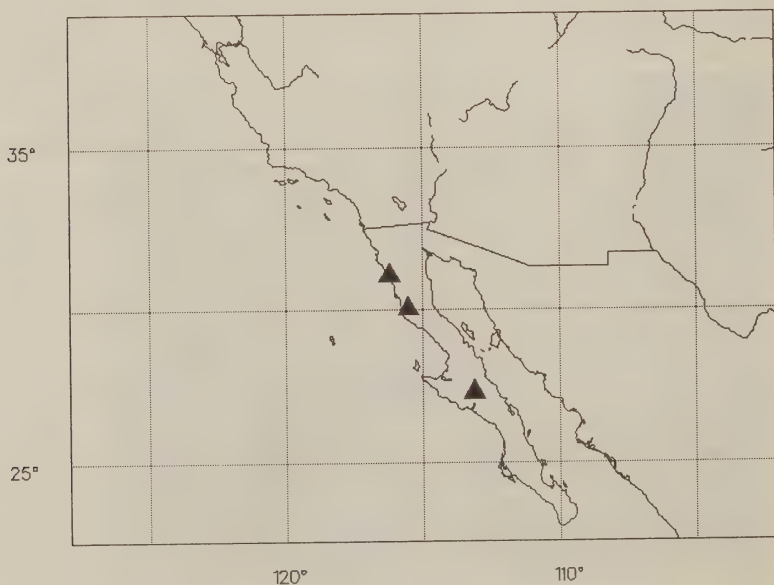


Fig. 2. *Miriquidica mexicana*, distribution.

The color of the epithelial pigment varies from olive-green to almost blue-green. It reacts HCl+ blue, $\text{HNO}_3_{[50\%]}$ + pink. In their earliest stages the apothecia are aspicilioid and immersed in the thallus areoles. The surrounding thallus develops a whitish-pruinose, raised rim, which soon develops into a black proper margin. This development forms a transition between lecideine or biatorine and lecanorine margination, a situation not known before in *Miriquidica*. Similar transitions are common in various genera of crustose lichens, e.g., *Schaereria*.

Another extension of the genus concept of *Miriquidica* is formed by the recent inclusion of *M. ventosa* from southern Finland and East Siberia (TIMDAL 1993). This is the only taxon in the otherwise crustose genus with a squamulose to subfoliose thallus and "Rhizinenstränge" as holdfasts. These structures may be homologous with the dendroid strands of the hypothallus of *M. mexicana*, which are, however, narrowly attached to the substrate. A parallel situation is found in the Icmadophilaceae, in which *Knightiella splachnirima* is the only squamulose to subfoliose taxon within a group of otherwise exclusively crustose taxa (RAMBOLD et al. 1993).

Additional specimens examined: MEXICO. Baja California: along Route 1, 2 km S of Colonet, coastal shrub community (*Agave shawii*, *Ambrosia chenopodifolia*, *Macherocereus gummosus*), volcanic rocks and some marine sediments of Paleocene origin, alt. 50 m, 31°04'N, 116°13'W, 27 December 1990, K. & A. Kalb, T. Nash et al. 24708 (hb. Kalb); 26 km E of El Rosario along hwy 1, on acidic rock, alt. 400 m, 30°03'N, 115° 27'W, 16 February 1987, T. H. Nash 25238 (ASU). – Baja California Sur: Along Route 1, 31 km W of San Ignacio on NE slope of a cerro at junction of road to Punta Abreojos, alt. 180–200 m, 27°20'N, 113°07'W, 7 January 1889, A. Aptroot 24660 (hb. Aptroot).

Acknowledgements

A special mention deserves the excellent fieldtrip to Baja California in 1989, organized by T.H. Nash (Tempe, USA), where one of us (H.S.) could participate and collect material of *M. mexicana*. Thanks are due to A. Aptroot (Baarn, The Netherlands) and K. Kalb (Neumarkt, Germany) for loan of specimens and to I. Brodo and T. H. Nash for reviewing the manuscript. This research was supported by the Deutsche Forschungsgemeinschaft (He 953/5) and the National Science Foundation (BSR 92-01111).

References

- EGAN, R. S. 1989. Changes to the "Fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada." Edition I. – *Bryologist* **92**: 68–72.
- HERTEL, H. & RAMBOLD, G. 1987. *Miriquidica* genus novum Lecanoracearum (Ascomycetes lichenisati). – *Mitt. Bot. Staatssammlung München* **23**: 377–392.
- NIMIS, P. L. 1993. The Lichens of Italy. An Annotated Catalogue. – Museo regionale di scienze naturali, Monografie **12**: 1–897.
- RAMBOLD, G. & SCHWAB, A. J. 1989. Rusty coloured species of the lichen genus *Miriquidica* (Lecanoraceae). – *Nordic J. Bot.* **10**: 117–121.
- RAMBOLD, G., TRIEBEL, D. & HERTEL, H. 1993. Icmadophilaceae, a new family of the Leotiales. In: Feige, G. B. & Lumbsch, H. T. (eds.): *Festschrift S. Huneck*. – *Biblioth. Lichenol.* **53**: 217–240.
- TIMDAL, E. 1993. *Miriquidica ventosa* comb. nov., a rediscovered lichen. – *Bryologist* **96**: 616–618.
- THOMSON, J. W. & WEBER, W. A. 1992. Lichens collected on the arctic excursion of the 9th International Botanical Congress (Montreal) in 1959. – *Bryologist* **95**: 392–405.
- VOBIS, G. 1980. Bau und Entwicklung der Flechten-Pycnidien und ihrer Conidien. – *Biblioth. Lichenol.* **14**: 1–141.

SPHAEROPHRAGMIUM QUADRICELLULARE SP. NOV. (MYCOTA, UREDINALES) ON ACACIA IN AUSTRALIA, WITH BRIEF NOTES ON SOME RELATED RUST GENERA

J.L. Alcorn¹ and J. Walker²¹ Plant Protection Unit, Department of Primary Industries, Indooroopilly, Queensland 4068, Australia² 5 Cook Street, Baulkham Hills, New South Wales 2153, Australia

A telial rust on leaves of *Acacia pennata* ssp. *kerrii* from Cape York Peninsula is described as *Sphaerophragmium quadricellulare* sp. nov. No other spore stages have been observed. Brief notes on other related rusts occurring in Australia are given.

In 1984, a heavily rusted collection of *Acacia pennata* (L.) Willd. ssp. *kerrii* I. Nielsen from Cape York Peninsula was brought to the attention of the senior author. *Acacia pennata* ssp. *kerrii* is a prickly liana with bipinnate leaves, up to 20 pinnae per leaf and 25-30 pairs of leaflets on each pinna (Ross, 1991). In Australia it is known only from the tip of Cape York Peninsula, but it occurs in South East Asia from North Eastern India, through Burma, Thailand, Laos and Cambodia to the Indonesian Archipelago (Nielsen, 1985; Ross, 1991). On the collection discussed here, two rusts were seen on the leaflets, both present only as teliospores. The predominant rust is a species of *Sphaerophragmium*, described below. The other, with only a few telia present, is a species of *Ravenelia* but insufficient material is available to allow specific identification (pers. obs.; Prof. G.B. Cummins, pers. comm., 1984). The new species of *Sphaerophragmium* described here is only the second reported from the genus *Acacia* and adds another to the sixteen species accepted in the recent monograph of the genus (Lohsomboon, Kakishima and Ono, 1994).

Sphaerophragmium quadricellulare Alcorn & J. Walker, sp. nov. (Fig. 1) *Pycnia*, *aecia* et *uredinia* non visa. *Telia* in foliolis abundantia, amphigena sed in pagina inferiore (abaxiali) foliolorum plura, obscure porphyrea, erumpentia et fragmentis epidermidis cuticulaeque cingentia (vel in parte), parva, ad 0.25mm diam. singulatim, interdum 2-4 plusminusve confluentia in soros latiores compositos sed plerumque dispersa singulatim. *Teliosporae* rufo-brunneae, pedicellatae, capitula globosa vel subglobosa vel aliquantum applanata dorsiventralia, plerumque quadricellulares, 22-28 x 28-38µm, pariete externo 1.5-2µm crasso, 2.5-3.5 (-4)µm ad juncturam cellulas, laeves praeter 20-25 appendices super paginam teliosporae disperses, pori germinales non visi. *Appendices* 4-15 (praecipue 10-15)µm longae, 2-4µm latae ad basim, 1-2.5µm proxime infra apicem, ad apicem bi- vel tri- (interdum quadri-) ramosae, rami breves, plerumque recurvati et harpagonem simulant.

Pedicellus teliosporae hyalinus, interdum pallide brunneus proxime infra capitulum, 30-70µm longus, 7-11µm latus ad hilum, infra leviter angustius, persistens, non-septatus, pariete 1-1.5µm crasso, plerumque laevis sed in parte infirma tertia asperitate tenue. *Paraphyses* praesentes, non abundantes, in soris peripherales, cylindricae apice obtuso, rectae vel parum incurvatae, (35-) 40-55 (-60)µm longae, 7.5-11µm latae, pariete usque ad 4µm crassum et lumine plerumque multum deminuto, luteo-brunneae, plerumque septo uno prominenti in parte infirma tertia.

Holotypus: in foliis *Acaciae pennatae* ssp. *kerrii*, Laradeenya Creek, Cape York Peninsula, Australia (10° 47' S, 142° 29' E), 8 Sept. 1979, B.P.M. Hyland 21051 V (BRIP 14183a). *Isotypi*: BRI 278980, DAR 49482, PUR 88117.

Pycnia, *aecia* and *uredinia* not seen. *Telia* abundant on leaflets, amphigenous but more numerous on lower (abaxial) surface, dull reddish-brown, erumpent and surrounded or partly surrounded by flaps of epidermis and cuticle, small, to 0.25mm diam. individually, sometimes 2-4 clustered into larger compound sori but generally scattered individually. *Teliospores* mid reddish-brown, globose to subglobose or somewhat flattened dorsiventrally, mostly four-celled, 22-28 x 28-38µm, with outer walls 1.5-2µm thick, 2.5-3.5 (-4)µm at junction of cells, smooth except for 20-25 appendages scattered over the spore surface, germ pores not observed. *Appendages* bi- or tri- (occasionally quadri-) furcate at apex with short, usually recurved branches, 4-15 (mainly 10-15)µm long, 2-4µm diam. at base, 1-2.5µm just below apical branches, apex to 4µm wide across the branches and resembling a grapnel. *Pedicel* of teliospores hyaline, sometimes pale brown adjacent to spore, 30-70µm long, 7-11µm wide at hilum, slightly narrower below, non-septate, with wall 1-1.5µm thick, smooth except for the lowest third which is finely roughened. *Paraphyses* present, not abundant, peripheral in sori, cylindrical with an obtuse apex, straight or slightly incurved, (35-) 40-55 (-60)µm long, 7.5-11µm wide, wall to 4µm thick and lumen usually much reduced, yellowish-brown, usually with one distinct septum in the lowest third.

Sphaerophragmium quadricellulare differs in several respects from *S. silveirae* Speg., the only other species reported from *Acacia* and known only from the type collection on *Acacia pedicellata* Benth. in Brazil (Monoson, 1974; Lohsomboon, Kakishima and Ono, 1994). *Sphaerophragmium silveirae* was described with 3-9 celled teliospores (8-celled according to Monoson (1974) who re-examined the type specimen) and teliospore appendages only up to 2.5µm long, with 2-3 short apical branches. The teliospores were also larger (25-35 x 33-48µm, fide Monoson, 1974) than those of *S. quadricellulare*. Apart from *S. quadricellulare*, eight other species of *Sphaerophragmium* with four-celled teliospores are known. Two of these, *S. parkiae* Dennis and *S. albiziae* Lohsomboon, Kakishima & Ono, occur on hosts in the family Mimosaceae. However, *S. parkiae* has teliospore appendages only 1-5µm long and sometimes branched near the tip, and the appendages of *S. albiziae* are of a similar length but unbranched and with an obtuse tip. These two species also have associated uredinia. Three other species, *S. evernium* H. Sydow (on *Dialium*, Caesalpinaceae), *S. irregularis* Arthur & Cummins (on *Strongylodon*, Fabaceae) and *S. mucunae* Raciborski (on *Mucuna*, Fabaceae), also occur on legumes. Like *S. quadricellulare*, *S. evernium* is known only in the telial stage but it differs in having somewhat larger, less flattened teliospores with shorter appendages than *S. quadricellulare*. The other two

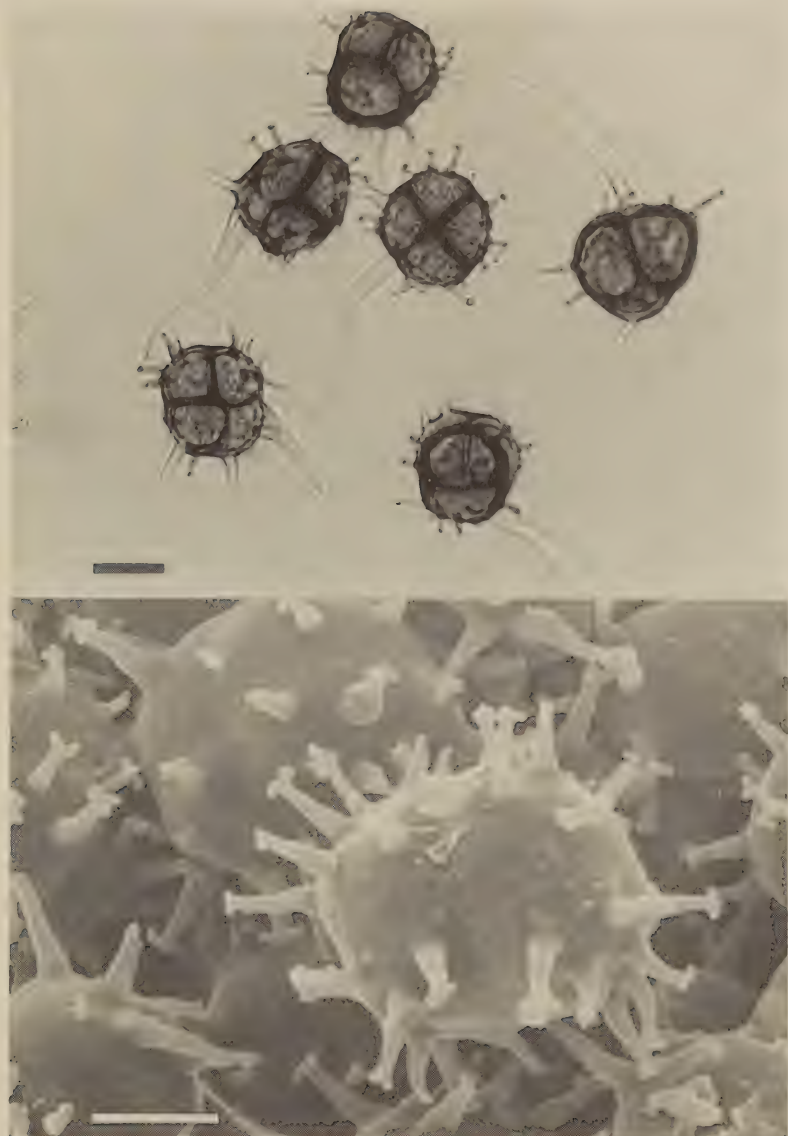


Fig. 1. Teliospores of *Sphaerophragmium quadricellulare* (BRIP 14183a). Scale bars = 20µm (upper), 10µm (lower).

species have uredinia associated with the telia and their teliospores are larger with shorter appendages than found in *S. quadricellulare*. Of the remaining three species, *S. artabotrydis* Doidge and *S. boanense* Cummins occur on hosts in the unrelated family Annonaceae, and differ in teliospore size and ornamentation; and *S. debile* Sydow & H. Sydow is no longer considered a species of *Sphaerophragmium* as its teliospores are subtended by colourless cysts, and it has recently been transferred to the genus *Spumula* as *Spumula debilis* (Sydow & H. Sydow) Lohsomboon, Kakishima & Ono (1994, as '*debile*').

Sphaerophragmium quadricellulare is the second species of the genus found in Australia but the first on an indigenous host. The other species, *S. acaciae* (Cooke) Magnus, has been found in both its uredinial and telial stages on the introduced *Albizia lebbbeck* (L.) Benth. and *A. falcata* (L.) Fosb., and on *A. procera* (Roxb.) Benth. (Mimosaceae) in Queensland (Simmonds, 1966; see specimens examined below) and as uredinia in two collections on *A. lebbbeck* from the Northern Territory. It probably is present also in the north of Western Australia, as several teliospores characteristic of *S. acaciae* were found loose on the surface of leaves of the grass *Cenchrus elymoides* F. Muell., infected with *Puccinia levis* (Sacc. & Bizz.) Magnus var. *levis*, collected on an island in Prince Frederick Harbour, at the mouth of the Hunter River, north-west Kimberley district. *Sphaerophragmium acaciae* is quite distinct from *S. quadricellulare* in having larger (6-) 8 celled teliospores, with shorter wall appendages (usually less than 10µm long) and somewhat stouter (longer and wider) teliospore pedicels which, like those of *S. quadricellulare*, are finely roughened on their lower third.

The genus *Sphaerophragmium* was not included amongst the nine genera and 161 species of rusts accepted in Australia at that time by McAlpine (1910). Its earliest records date from the 1963 collections in Queensland of *S. acaciae* by Dr R.F. Langdon (see collections listed below) and reported by Simmonds (1966). Although there are differing opinions concerning the definition and extent of the family, *Sphaerophragmium* is accepted here as a member of the family Raveneliaceae Leppik (1972), as circumscribed by Savile (1989). Of the 38-40 rust genera and over 400 species currently known (Feb. 1995) in Australia (J. Walker, unpublished Australian rust census data), seven genera belong in this family. In addition to *Sphaerophragmium*, these include *Atelocauda* (with two species, formerly as *Uromyces*) and *Uromycladium* (eight species), all on *Acacia* hosts; *Ravenelia* (four or five species) on *Acacia* (Mimosaceae) and *Cassia* (Caesalpiniaceae); *Kernkampella* (two species) on *Breynia* and *Phyllanthus* (Euphorbiaceae); *Nyssopsora* (one species) on *Citriobatus* (Pittosporaceae), and *Tranzschelia* (one species) on *Prunus* (Rosaceae, uredinia and telia) and *Anemone* (Ranunculaceae, pycnia and aecia). With the exception of *Sphaerophragmium acaciae* on the introduced *Albizia lebbbeck* and *A. falcata* and *Tranzschelia discolor* (Fuckel) Tranz. & Litv. on introduced *Prunus* and *Anemone*, all these rusts appear to be native and occur on native hosts.

In Australia, the host of *S. quadricellulare*, *Acacia pennata* ssp. *kerrii*, is known only from the northernmost part of Cape York Peninsula, at what appears to be the southern

limit of its South East Asian distribution. A search for *S. quadricellulare* in other countries where the host occurs could well extend the known limited distribution of this rust. At least one other rust is known on *A. pennata* ssp. *kerrii*, from Indonesia on the island of Java, and this will be considered elsewhere with several other *Acacia* rusts (J. Walker, unpublished).

Collections examined: *Sphaerophragmium acaciae* (Cooke) Magnus: on *Albizia lebbek* (L.) Benth., Wellington Point, Brisbane, Queensland, 5 Oct. 1963, R.E. Gould, det. R.F. Langdon, II, III, DAR 21322 (ex BRIU without number); Charters Towers, Queensland, 15 August 1963, J. Banks, det. R.F. Langdon, II, III DAR 21323 (ex BRIU without number); Nhulunbuy, Gove Peninsula, Northern Territory, May 1984, H.Y. Yip, DAR 49517; different collection, same locality, date and collector, DAR 49518, both II only; Zillmere, Queensland, 4 July 1968, J.L. Alcorn, BRIP 6068; Cairns, Queensland, 23 August 1975, J.H. Simmonds, BRIP 8992; Ormiston, Queensland, 27 September 1975, J.L. Alcorn, BRIP 11133; Southedge Research Station, Mareeba, Queensland, 23 May 1993, R.D. Davis, BRIP 21058; on *Albizia falcataria* (L.) Fosb.: Brisbane, Queensland, June 1979, P. Foot, BRIP 13074; on *Albizia procera* (Roxb.) Benth.: Brisbane, Queensland, June 1979, P. Foot, BRIP 13073; on *Albizia* sp.: Wynnum West, Queensland, 27 August 1976, R. Ruff, BRIP 11757; 26km north of Gympie, Queensland, 14 September 1991, J.L. Alcorn, BRIP 19474; loose teliospores on leaves of *Cenchrus elymoides* F. Muell., infected with *Puccinia levis* (Sacc. & Bizz.) Magnus var. *levis*, island, Prince Frederick Harbour, mouth of Hunter River, north-west Kimberley district, Western Australia, 10 June 1984, K.F. Kenneally 8971, DAR 51184 (ex UWA 2978).

Sphaerophragmium quadricellulare Alcorn & J. Walker: on *Acacia pennata* (L.) Willd. ssp. *kerrii* I. Nielsen, Laradeenya Creek, Cape York Peninsula, 8 Sept. 1979, B.P.M. Hyland 21051V, III, BRIP 14183a (Holotype), BRI 278980, DAR 49482, PUR 88117 (Isotypes).

Mr L. Pedley (Herb. BRI) is thanked for drawing our attention to this interesting rust. Professor G.B. Cummins (Tucson, Arizona, U.S.A.) kindly examined material and confirmed its novelty. The cooperation of Dr M. Kakishima (Tsukuba, Japan) in making available a draft copy before publication of the monographic paper on *Sphaerophragmium* by Lohsomboon, Kakishima and Ono is gratefully acknowledged. We also thank Mr D.H. Gowanlock (formerly QDPI, Indooroopilly) for taking the electron micrograph. The junior author is grateful to the Agricultural Scientific Collections Trust and the New South Wales Department of Agriculture for access to the collections of Herb. DAR and for laboratory and library facilities.

References

- Leppik, E.E. 1972. Evolutionary specialization of rust fungi (Uredinales) on the Leguminosae. *Annales Botanici Fennici* 9: 135-148.
- Lohsomboon, P., Kakishima, M. and Ono, Y. 1994. A monograph of *Sphaerophragmium* (Uredinales). *Mycological Research* 98: 907-919.
- McAlpine, D. 1906. *The Rusts of Australia. Their structure, nature and classification*. Melbourne: R.S. Brain, Government Printer.

- Monoson, H.L. 1974. The genus *Sphaerophragmium*. *Mycologia* 66: 791-802.
- Nielsen, I. 1985. The Malesian species of *Acacia* and *Albizia* (Leguminosae-Mimosoideae). *Opera Botanica* 81: 1-50.
- Ross, J.H. 1991. *Acacia pennata* (L.) Willd. subsp. *kerrii* I. Nielsen (Mimosaceae), a new record for Australia. *Austrobaileya* 3:555.
- Savile, D.B.O. 1989. Raveneliaceae revisited. *Canadian Journal of Botany* 67: 2983-2994.
- Simmonds, J.H. 1966. *Host Index of Plant Diseases in Queensland*. Brisbane: Queensland Department of Primary Industries.

STUDIES ON ITALIAN GASTEROMYCETES. I. TWO NEW SPECIES OF ARACHNION AND RADIIGERA (BASIDIOMYCOTINA, LYCOPERDALES) FROM ROME AND ITS ENVIRONS.

LIVIO QUADRACCIA

*Laboratorio di Micologia, Dipartimento di Biologia Vegetale
Università degli Studi di Roma "La Sapienza"
Largo Cristina di Svezia 24, 00165 Roma, Italy.*

SUMMARY

Two new species of Gasteromycetes are described and illustrated from Central Italy, viz. *Arachnion iulii* and *Radiigera romana*. Their taxonomic position is discussed and a comparison with taxonomically related taxa is provided.

KEY WORDS: Basidiomycotina, Gasteromycetes, Lycoperdales, *Arachnion*, *Radiigera*, Taxonomy, New species, Italy.

INTRODUCTION

As a result of its peculiar geographical position as well as by reason of its specific climatic and orographic features, Italy is home to many species of Gasteromycetes, both apogees and hypogeous.

Since the 1909 contribution by Petri in *Flora Italica Cryptogama*, which dealt only with a few groups of Italian Gasteromycetes, no other comprehensive revision of these singular fungi has been started on a national scale. Accordingly, from the beginning of the century to date, the contributions to a better knowledge of Italian Gasteromycetes have been occasional and sporadic and on the whole, in sharp contrast to what has been accomplished for the other taxonomic groups such as the Agaricales, Boletales, Russulales, etc., not been conducive to any in-depth understanding of these fungi in our country.

Personally, since my first paper (Quadraccia, 1977) on *Gyrophragmium dunalii* (Fr.) Zeller, I have been interested in the study of Gasteromycetes, especially those growing in Central Italy. In fact, since then I have reported on a number of interesting taxa. These include *Pseudocolus fusiformis* (Fisch.) Lloyd (Quadraccia, 1983), previously of uncertain presence in Italy, *Gastrocybe lateritia* Watling (Watling et al.,

1986), first record in Europe, and *Colus hirudinosus* Cav. et Séch. (Quadraccia & Ubrizsy-Savoia, 1987), first record in Latium. I also provided data on *Tulostoma cyclophorum* Lloyd in Italy (Demoulin, 1984) as well as the descriptions of *Geastrum morganii* Lloyd, *Nidulariopsis iowensis* (Walk.) Zeller and *Lycoperdon lividum* Pers., all new to the mycoflora of Italy (Quadraccia & Lunghini, 1990), and an *Arachnion* sp. which in the present paper is proposed as a new species.

The present work is meant to be the first of a standing series on Italian GASTEROMYCETES, with a view to supporting the implementation of an exhaustive revision of the extant flora.

MATERIALS AND METHODS

Microscopic features were described using free-hand sections of basidiocarps from fresh and dried material, mounted in H₂O, in 3% KOH or in Melzer's reagent, and squashed. All microscopic measurement were made from structures mounted in lactophenol or in lactophenol-cotton blue. Small portions of dried tissue were revived by wetting with 95% ethanol and soaking in water before sectioning. Spore dimension ranges are based on the measurement, under oil-immersion objective (x 1000), of 20-30 random mature spores, selected for each collection. Spores measurements are recorded excluding the ornamentation. Colour terms in parentheses are those of Kornerup & Wanscher (1978), designed as plate, column and row; other color names are not standardized.

Scanning Electron Microscopy (SEM) photomicrographs were obtained with a Stereoscan 200 Cambridge. Spores were mounted with RX-glue on a aluminum stub or in a drop of 50% ethanol and dispersed, under a stereo-microscope, with a fine needle on aluminum stub, and later dried in the air. The stubs were coated with a layer of gold-palladium of 500 Å for 120 sec., under vacuum in an atmosphere of Argon, at 1.4 KV and 18 mA, and processed in a standard sputter. Observations were made at either 15 or 25 KV, according to the conditions of the sample.

The specimens cited in this paper are deposited at RO. Herbarium names are abbreviated by acronyms according to *Index Herbariorum* (Holmgren et al., 1990).

TAXONOMIC PART

***Arachnion iulii* Quadraccia, sp. nov. (figs 1, 2)**

Etymology.: The name is dedicated to my son Giulio.

Basidiocarpi subglobosi, 10-18 mm lati, 8-15 mm alti, epigaei. Exoperidium laeve, albidum, papyraceum. Endoperidium abest. Stoma abest. Disperguntur spores delecto radiate non aequaliter peridio. Gleba ex alba subvirescens in maturitate, in parva fragmenta divisa, cum glebae cellis congruentia. Subgleba abest. Spores (4) 4.5-6 (6.5) x 3.5-4 (4.2) µm, ellipticae vel subellipticae, leves, longe pedicellatae, fusco-

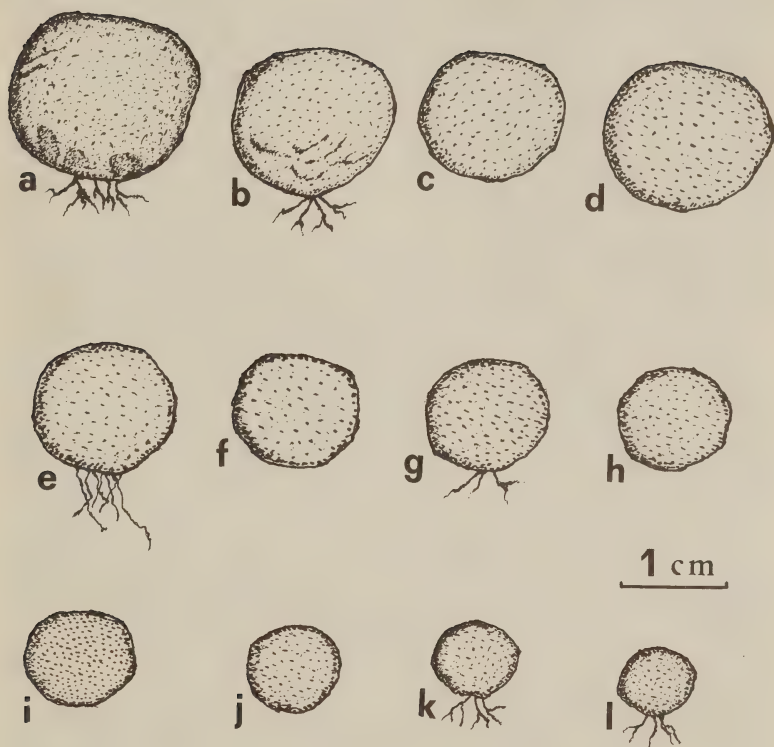


Fig. 1. *Arachnion iulii*: a to l - Macroscopic morphological characteristics of fresh unexpanded basidiocarps of different size; N° 1211 LQ, RO, holotype.

sufflavae. *Capillitium* abest. *Tunica perspicua circumscribuntur cellae glebales, quae in maturitate plane disiungi possunt.*

Habitat: in litoris rarioribus silvis sabulosis sub *Cisto salvifolio* L.

Holotypus: Italia, prope Tenuta Presidenziale di Castelporziano (RM), in loco dicto "Fontanile Pepparello" lectus, 28 Oct. 1987, leg. L. Quadraccia, in herbario Auctoris apud RO conservatur, no. 1211 LQ (RO).

Paratypus: *ibid.*, 22 Oct. 1991, leg. L. Quadraccia, no. 1305 LQ (RO).

Fruitbodies subglobose, 10-18 mm wide and 8-15 mm high, epigeal. Exoperidium smooth, whitish (2A1), papyraceous. Endoperidium absent. Stoma absent. Spore liberation and dispersal through an irregularly radial disruption of the peridium. Gleba white to light greenish when ripe (3B7-B8), divided into tiny particles which coincide with glebal chambers. Subgleba absent. Rhizomorphs short, whitish, simple or branched. Spores (4) 4.5-6 (6.5) $\times$ 3.5-4 (4.2) μ m, elliptic or subelliptic, smooth, with a long pedicel, yellowish-brown. *Capillitium* absent. Glebal chambers neatly delimited by a glebal membrane and perfectly separable when mature.

Habitat: in bare patches of sea-shore woods under *Cistus salvifolius* L..

Specimens examined:

- ITALY, Castelporziano Presidential Estate (Roma), loc. "Fontanile Pepparello", a clearing in a coastal wood of *Quercus suber* L. and *Q. frainetto* Ten, under *Cistus salvifolius*, 28 Oct. 1987, L. Quadraccia, no. 1211 LQ (RO), holotype; *ibid.*, 22 Oct. 1991, L. Quadraccia, no. 1305 LQ (RO), paratype.

Among the fourteen species included in *Arachnion* Schw. (= *Scoleciocarpus* Berk), *A. iulii* is most closely related to *A. album* Schw., an American species, and the type of the genus. *Arachnion drummondii* Berk, from Australia, and *A. tener* (Berk.) Long, from South Africa, are similar and also lack both the endoperidium and capillitium and have elliptic, long-pedicelled spores. These are characters shared by *A. album* which differs from *A. iulii* in having ovoid, smaller and unpedicelled spores. The spores of *A. drummondii* are also subglobose, smaller (4.8-5.0 μ m) and unpedicellate. *Arachnion tener* has pedicellate spore like those of *A. iulii* but is clearly different because they are subglobose and very small, 3.7-4.0 μ m. Two other species which differ from *A. iulii* by having a well developed endoperidium and typical capillitial hyphae with septa are *A. lazoi* Demoulin and *A. lloydianum* Demoulin (Demoulin, 1972). *Arachnion lazoi* has globose spores with a short pedicel (1.5 μ m) when present and capillitial branches with frequent septa which appear like the spines in *Mycenastrum* Desv. *Arachnion lloydianum* has capillitial branches with very sparse septa, frequent pores but the branching is also similar to the spines of *Mycenastrum*.

In the field *A. iulii* is macroscopically similar to a species of *Bovista* Pers.: Pers. but the distinctive sand grain-like glebal chambers are unmistakably diagnostic. The propagules or diaspores in *Arachnion* are wind dispersed like sand grains and lack both capillitium and endoperidium. Since *A. iulii* possess both of these characteristics it is to be regarded as a primitive genus which has evolved close to the Sclerodermales. I would also agree with Demoulin (1972) who considered the genus *Arachniopsis* Long,

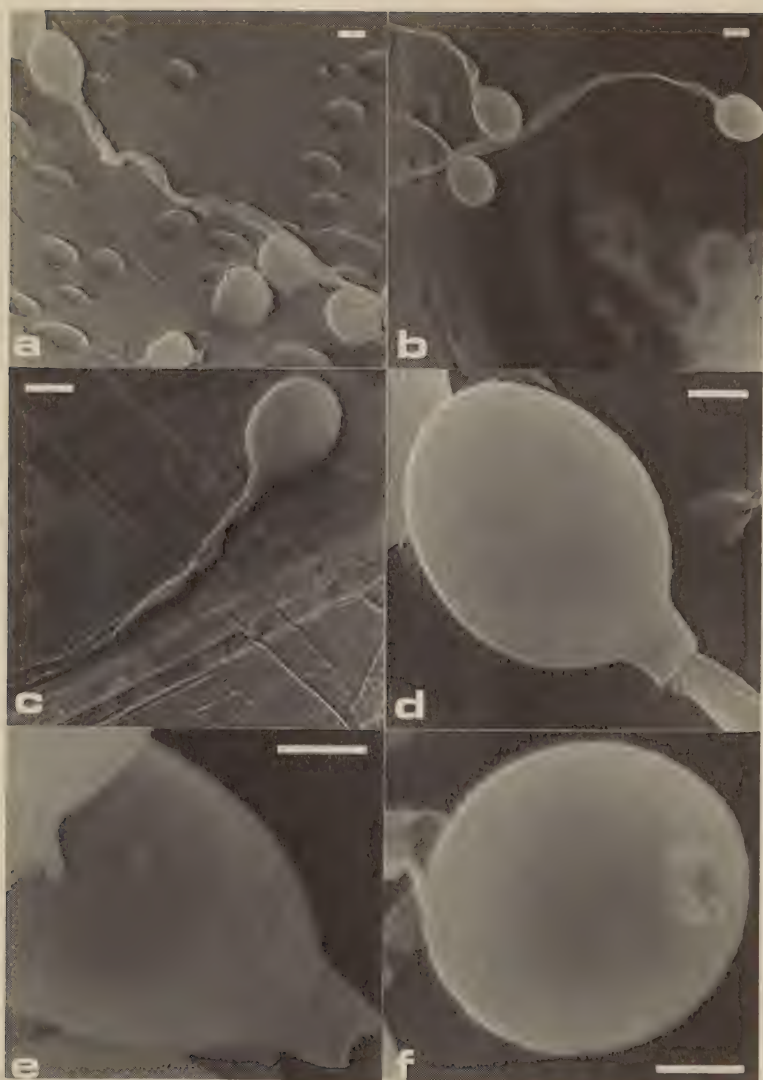


Fig 2. *Arachnon iulii*: SEM-pictures, **a,b,c** - Smooth spores with a long pedicel (bar = 2 μ m). **d** - Detail of the apiculus with a pedicel (bar = 1 μ m). **e, f** - Smooth spores with distinct apiculus (bar = 1 μ m); N° 1211 LQ, RO, holotype.

(1917, 1941) as a later synonym of *Arachnion*. There seems to be no point in segregating the species with capillitium from the rest of the taxa in the genus.

Two species have been excluded from the genus including *A. rufum* Lloyd (1906) regarded by Cunningham (1942) as a *Geastrum* and *A. aurantiacum* (Rafin.) de Toni in Saccardo (1888) considered a *nomen dubium* [*"Arachnion aurantiacum* (Rafin.) de Toni" sic].

Arachnion is included in the Lycoperdales, in the family Arachniaceae, erected by Coker and Couch (1928) listing *A. album* as the only species. In light of the present knowledge of the genus, the family Arachniaceae differs from the Lycoperdaceae mainly in the gleba with glebal chambers which when ripe, or mature, split up like sand grains. This character, however, is also present in *Morganella* Zeller (Kreisel & Dring, 1967) which underscores the separation of the genus *Arachnion* from the Lycoperdaceae as a very specialized ancestral group.

***Radiigera romana* Quadraccia, sp. nov. (figs 3, 4)**

Etymology.: from the geographical name to the locality where the holotype was found.

Basidiocarpi globoso-depressi, 10-25 mm lati, 10-18 mm alti, epigaei vel semihypogaei. Peridium laeve, albido-isabellinum, tribus ex stratis proprie compositum. Stoma abest. Disperguntur sporae deleto radiate non aequaliter peridio. Gleba ex alba fuscobrunnea in maturitate. Mycelium ad basim album. Cimicis odor. Sporae 5-7.5 µm ornamentis exceptis (verrucae 0.8-1.2 µm altae), globosae vel subglobosae, verrucoso-tuberculosae, subreticulatae, luteobrunneae vel brunneae in H₂O. Pseudocolumella ex hyphis ramosis fibulis praeditis constituta et ex cellulis clavaeformibus fibulis praeditis in latiore parte. Capillitium ex longis elementis compositum dense incrustatis (4-5 µm latis), tunica valde crassa atque interiore parte perangusta praeditum. Exoperidium 100-200 µm crassum, hyphis longis filamentosis intextis constitutum, fibulis praeditis ac materia brunneo-russea incrustatis una cum crystallis hyalinis rectianguli vel quadrati formam habentibus. Mesoperidium pseudoparenchymaticum, 1000-1250 µm crassum, cellulis non aequaliter globosis constitutum, ovatis vel ellipsoideis, tunicis subtilibus praeditis, 21-53 x 14-37 µm, hyalinis in KOH et in liquore Melzerio. Endoperidium 125-165 µm crassum, ex hyphis filamentosis constitutum arte intextis, tunicis subtilibus (1) 2-4 µm, fibulisque praeditis, flavis in KOH et in liquore Melzerio.

Habitat: in solo sabuloso-argillaceo, sub Cupresso sempervirenti L., una cum Battarraea phalloidi, hiberno tempore.

Holotypus: Italia, prope Orto Botanico di Villa Corsini, in Urbe Roma, in loco dicto "Conifere" lectus, 22 Jan. 1992, leg. L. Quadraccia, in herbario Auctoris apud RO conservatur, no. 1325 LQ (RO).

Paratypes: ibid., 16 Dec. 1992, legit L. Quadraccia, no. 1326 LQ (RO); ibid., 7 Jan 1993, legit L. Quadraccia, no. 1327 LQ (RO).

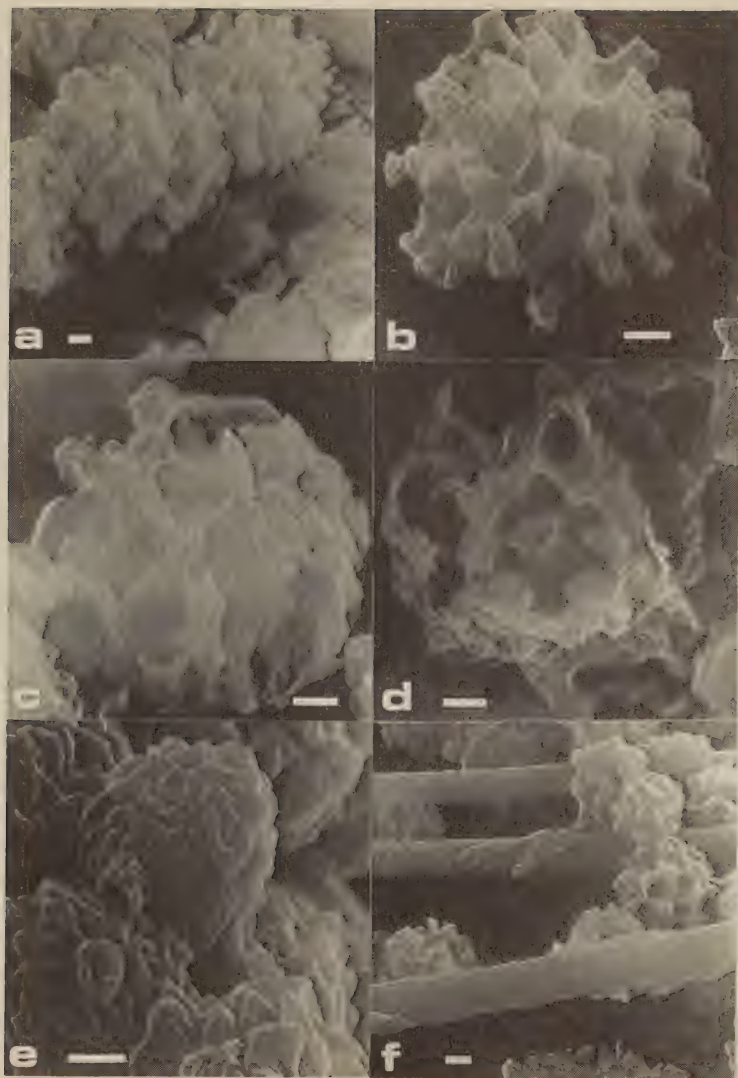


Fig 3. *Radiigera romana*: SEM-pictures a, b, c, - Tuberculate-warted or subreticulate spores (bar = 1 μ m), d - Spore with apiculus visible (bar = 1 μ m), e - Not fully mature spores showing the apiculus (bar = 1 μ m), f - Capillitial hyphae with no slits or pores (bar = 2 μ m); N° 1325 LQ, RO, holotype.

Fruitbodies depressed-globose, 10-25 mm wide and 10-18 mm high, epigeal or semihypogean. Peridium smooth, whitish to buff (3A2-4A2), typically three-layered. Umbo absent. Stoma absent. Spore liberation and dispersal through an irregular disruption of the peridium. Gleba soft, moist, radially arranged around a pyriform pseudocolumella 2.5-7.5 x 4-5 mm; at first firm, later ripening into a powdery capillitium and spores (7F4-F5). Mycelial layer white. Odour resembling that of the green field bug, especially on cutting.

Spores 5-7.5 μm (excluding ornamentation), globose to subglobose, warted-tuberculate (warts 0.8-1.2 μm high), subreticulate, yellow-brown to brown in H_2O . Pseudocolumella consisting of branched, clamped hyphae and numerous clavate cells with clamps in the enlarged end intermixed with typical clavate cells with carmel to golden-brown contents in H_2O and KOH. Capillitium formed by long, thickly encrusted, unbranched hyphae (4-5 μm wide), with very thick walls and a very narrow lumen, yellow brown in H_2O , pores and fissures absent. Exoperidium 100-200 μm thick, made up of long, filamentous, clamped interwoven hyphae, with reddish-brown incrustations consisting of mixed to rectangular or square, hyaline crystals. Mesoperidium pseudoparenchymatous, 1000-1250 μm thick, consisting of irregularly globose, oval or elliptical cells 21-53 x 14-37 μm , thin-walled and hyaline in KOH and Melzer's solution. Endoperidium 125-165 μm thick, formed by filamentous, densely interwoven hyphae, with thin-walls and clamp connections, yellow in KOH and Melzer's solution.

Habitat: epigeal or semihypogean on sandy-clay soil, under *Cupressus sempervirens* L. along with *Battarrea phalloides* (Dicks.) ex Pers., fruiting in the winter.

Specimens examined:

- ITALY, Botanical Garden of Villa Corsini in Rome, loc. "Conifere", under *Cupressus sempervirens* with *Battarrea phalloides*, 22 Jan. 1992, L. Quadraccia, no. 1325 LQ (RO), holotype; *ibid.*, 16 Dec. 1992, L. Quadraccia, no. 1326 LQ (RO), paratype; *ibid.*, 7 Jan. 1992, L. Quadraccia, no. 1327 LQ (RO), paratype.

Six species can be assigned to the genus *Radiigera* Zeller (1944), all described from the American continent. Only *R. puiggarii* (Speg.) Singer, Wright & Horak (Singer et al., 1963) was not and it was subsequently transferred to *Morganella* Zeller by Kreisel & Dring (1967). Kers (1976) reported *R. atrogleba* from central Sweden, the first record in Europe. Therefore *R. romana* is the second *Radiigera* species to be found in Europe, directly in the middle of Rome, in Trastevere, inside the Botanical Garden of Villa Corsini, which belongs to the University of Rome "La Sapienza".

Radiigera romana is characterized by small, light-coloured fruitbodies, the cimicic (bed bug-like) smell and the growth in winter, at least in the type locality. Microscopically, the large spores, actually the largest in the genus to date, with warty-tuberculate and subreticulate ornamentation are diagnostic. In the field the new taxon bore some resemblance to a member of the Lycoperdaceae, but a deeper analysis of both macro- and micro-characters prompted its inclusion in *Radiigera*, as confirmed by O. K. Miller, Jr. (pers. comm.) The analogies between *Radiigera* and *Geastrum* Pers. are truly remarkable, however none of the specimens of *R. romana* has ever shown any of the characters typical of *Geastrum*, viz. a star-like apical opening, a peristome or pointed apex prior to the ripening of the fruitbody. In addition, several specimens which were

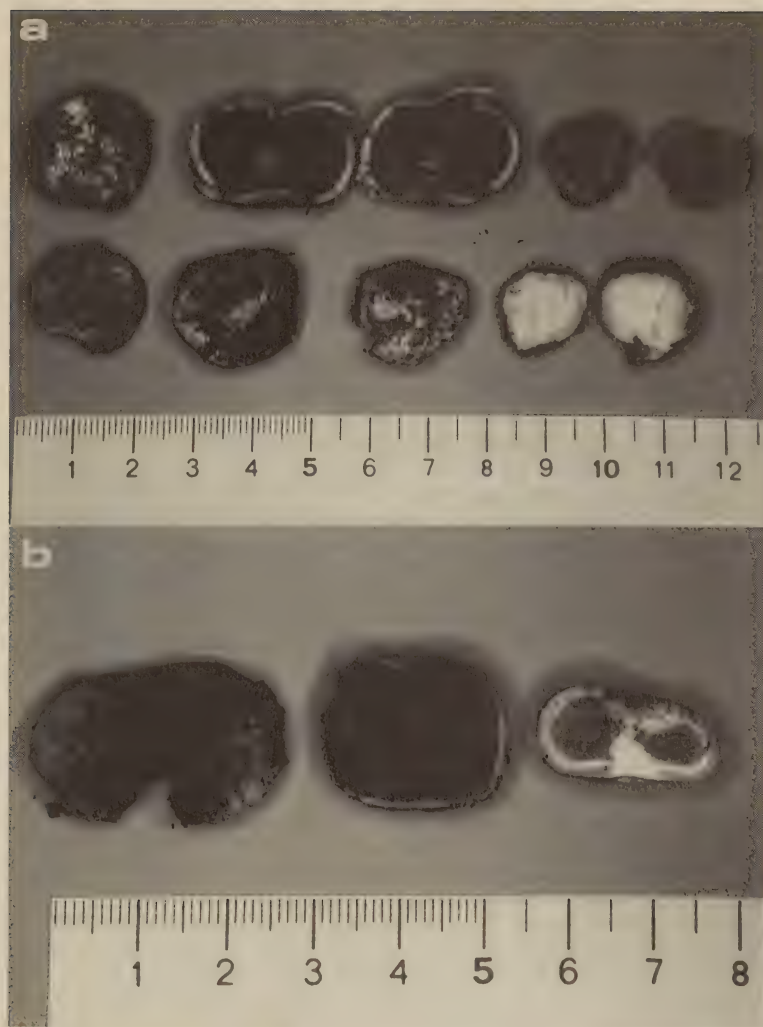


Fig 4. *Radiigera romana*: a, b - Macroscopic morphological characteristics of fresh unexpanded and expanded basidiocarps of different size and shape, a N° 1325, LQ, RO, holotype; b, N° 1327, LQ, RO, paratype.

left to mature in the field, have never reached a *Geastrum*-like type of development. Spore discharge was accomplished by an irregular disruption of the peridium.

Of all the *Radiigera* species so far described, only *R. fuscogleba* could bear a vague resemblance to *R. romana* both in the overall aspect and peridial morphology. At any rate, it can be separated immediately, but not exclusively by the smaller (*viz.* 4-5.5 μ m) and much less ornamented (warts 0.5-1 μ m) spores. *Radiigera romana* has been easily isolated in axenic culture on "Potato Carrot Dextrose Agar" (PCDA).

For comparison, the following herbarium material has been studied: *R. fuscogleba* [U.S.A., Montana, Yellow Bay on Flathead Lake, Lake Co., O. K. Miller 6614 (VPI); *ibid.*, B. Askew 387 (VPI)]; *R. atrogaleba* Zeller [U.S.A., Montana, Ashley L. Road, Flathead Co., O. K. Miller 8971 (VPI)].

Zeller (1944) erected the family Mesophelliaceae (Cunn.) Zeller to accomodate the genera *Mesophellia* Berk. and *Castoreum* Cooke et Massee with elliptic spores and the genera *Abstoma* Cunn. and *Radiigera* with globose spores. Later, the genus *Mesophelliopsis* Batista & Vital, a monotypic genus typified by *M. pernambucensis*, was first described from Brazil but present in Mexico as well (Batista & Vital, 1957; Guzman, 1971). It was also included in the family Mesophelliaceae. Recently on the basis of the detailed comparative work by Askew & Miller (1977), it is undisputable that *Radiigera* is closer to *Geastrum* than to *Mesophellia* and *Castoreum*, the sole two genera at present included in the family Mesophelliaceae. Both *Radiigera* and *Geastrum* show the same radial arrangement of the gleba, and identical structures of peridium and pseudocolumella, moreover they have similar capillitium, basidia and spores. Hence the inclusion of *Radiigera* in the family Gastraceae seems more rational. Similarly *Abstoma* is included in the family Lycoperdaceae (Bronchart & Demoulin, 1973), while *Mesophelliopsis*, still a little known genus of uncertain taxonomic position.

ACKNOWLEDGEMENTS

This research was supported through M.U.R.S.T 60% grant: "Mycofloristic researches in ecosystems of the Middle Tyrrhenian slope". I am most grateful to Dr. V. Demoulin (Liège) for discussion on *Arachnion*, and to Prof. O. K. Miller, Jr. (VPI) for discussions concerning *Radiigera* and for the loan of material. Furthermore, Dr. L. Del Caldo and Mr. G. Fusco are thanked for the SEM photos and technical assistance. Prof. R. Dell'Orbo (Rome) is thanked for his collaboration in producing the Latin diagnosis and Prof. E. Grilli (Popoli) for his help in the English translation. Thanks are also due to the Directors of the Castelporziano Presidential Estate for kind permission to carry out mycological researches on their property. Finally, I am very grateful to Prof. O. K. Miller, Jr. for the critical reading of the manuscript.

REFERENCES

- Askew, W. B. & Miller, O. K., Jr. (1977). New evidence of close relationships between *Radiigera* and *Geastrum* (Lycoperdales). *Can. J. Bot.* 55: 2693-2700.
 Batista, A. C. & Vital, A. F. (1957). Un novo Gasteromiceto da Familia Mesophelliaceae. *An. Soc. Biol. Pernambuco* 15: 13-18.

- Bronchart, P. & Demoulin, V.** (1973). Ultrastructure de la paroi sporale des steromycètes *Mycenastrum corium* et *Abstoma reticulatum* en rapport avec leur position systématique. *Bull. Soc. Roy. Bot. Belgique* 106: 267-272.
- Coker, W. C. & Couch, J. N.** (1928). *Gasteromycetes of the Eastern United States and Canada*. Univ. of North Carolina Press., Chapel Hill. 201 p.
- Cunningham, G. H.** (1944). *The Gasteromycetes of Australia and New Zealand*. J. McIndoe: Dunedin. 236 p.
- Demoulin, V.** (1972). Observations sur le genre *Arachnion* Schw. (Gasteromycetes). *Nova Hedwigia* 21(2-4): 641-655.
- Demoulin, V.** (1984). *Tulostoma cyclophorum* C. Lloyd [syn.: *T. pampeanum* (Speg.) Wright]. Gasteromycete mecunnu en Europe et dans le bassin mediterraneen. *Bull. Soc. Mycol. France* 100(2): 207-210.
- Guzman, G.** (1971). Notas sobre los generos *Radiigera* y *Mesophelliopsis* en Mexico. *Bol. Soc. Mex. Mic.* 5: 7-11.
- Holmgren, P. K., Holmgren, N. H. & Barnett, L. C.** (Editors) (1990). *Index Herbariorum*, part I, The Herbaria of the world, 8th edn. *Reg. Veg.* 120. New York, Botanical Garden, Bronx.
- Kers, L. E.** (1976). *Radiigera* Zeller, a genus of Gasteromycetes New to Europe. *Bot. Notiser* 129: 173-178.
- Kornerup, A. & Wanscher, J. H.** (1978). *Methuen Handbook of Colour*, 3th edn. London: Methuen. 243p.
- Kreisel, H. & Dring, D. M.** (1967). An emendation of the genus *Morganella* Zeller (Lycoperdaceae). *Feddes Repert.* 74: 109-122.
- Lloyd, C. G.** (1906). The Genus *Arachnion*. *Myc. Writ. II* (Myc. Notes 21): 252-254.
- Long, W. H.** (1917). Notes on new or rare species of Gasteromycetes. *Mycologia* 9: 271-274.
- Long, W. H.** (1941). Studies on Gasteromycetes III. The family Arachniaceae. *Mycologia* 33: 350-355.
- Petri, L.** (1909). *Gasterales. Flora Italica Cryptogama. Pars. I: Fungi*. Fascicolo 5. Rocca San Casciano. 139 p.
- Quadraccia, L.** (1977). *Gyrophragmium delilei* Montagne, specie nuova per la flora italiana. *Boll. Gruppo micol. "G. Bresadola" Trento*. 20(5-7): 133-139.
- Quadraccia, L.** (1983). *Pseudocolus fusiformis* (Fisch.) Lloyd in Italia. *Micol. Ital.* 12(2): 3-8.
- Quadraccia, L. & Ubrizsy-Savoia, A.** (1987). Microflora del Lazio. I. Censimento dei macromiceti laziali attraverso la bibliografia edita ed inedita e la loro riconferma attuale. *Ann. Bot. (Roma)*, Studi sul Territorio 45 (suppl. 5): 37-34.
- Quadraccia, L. & Lunghini, D.** (1990). Contributo alla conoscenza dei macromiceti della Tenuta Presidenziale di Castelporziano (Microflora del Lazio II). *Accademia Nazionale dei Lincei, Quaderno* 264: 49-120.
- Saccardo, P. A.** (1888). *Sylloge fungorum, omnium hucusque cognitorum*, vol. 7, pars I, *Gasteromycetum, Phycomycetum et Myxomycetum, digesserunt*. A. N. Berlese, J. B. De Toni et L. H. Fisher. Patavii. 492 p.
- Singer, R., Wright, J. E. & Horak, E.** (1963). "Mesophelliaceae" and "Cribbeaceae" of Argentina and Brazil. *Darwiniana* 12(4): 598-611.
- Watling, R., Quadraccia, L., Tabares, M. & Rocabrana, A.** (1986). *Gastrocybe* in Europe. *Notes RBG Edimb.* 43(2): 307-311.
- Zeller, S. M.** (1944). Representatives of the Mesophelliaceae in North America. *Mycologia* 36: 627-637.

STUDIES ON MEDITERRANEAN HYPHOMYCETES. I. PSEUDOSPIROPES DUMETI SP. NOV.

DARIO LUNGHINI* and FLAVIA PINZARI**

*Laboratorio di Micologia, Dipartimento di Biologia
Vegetale, Università degli Studi di Roma
"La Sapienza", Largo Cristina di Svezia 24,
00165 Roma, Italy.

**Via Marco Aurelio 2, 00184 Roma, Italy.

SUMMARY

A new dematiaceous Hyphomycete species, *Pseudospiropes dumeti*, found on dead wood of *Pistacia lentiscus* L. and *Phillyrea latifolia* L. in central Italy, is described and illustrated.

Keywords: Hyphomycetes, Italy, new species, taxonomy, *Pseudospiropes*.

In the course of mycological investigations carried out in two Mediterranean underbrush environments in central Italy, Elba Island (Livorno) and the reserved area of World Wildlife Fund "Macchiagrande" (Focene, Rome), respectively, the authors found a dematiaceous Hyphomycete which appeared to be new to science.

***Pseudospiropes dumeti* Lunghini et Pinzari sp. nov. (Figs 1, 2)**

Coloniae effusae, brunneae vel brunneo-subrubrae, setosae.

Mycelium in substrato praesertim immersum, ex hyphis levibus, ramosis, septatis a luteo ad brunneum colorem variantibus, 1.5–2.5 μm latis compositum.

Conidiophora macronemata, mononemata, solitaria vel caespitosa, erecta, recta vel flexuosa, 6–10-septata, levia, simplicia, fusco-brunnea, sursum pallidiora, 130–350 (192) $\times$ 3.8–5.7 (5.1) μm , deorsum usque ad 15 μm lata.

Cellulae conidiogenae polyblasticae, obpiriformes, integratae, terminales vel intercalares, sympodiales, plurimae cicatricibus claris, planis, modice inspissatis praeditae.

Conidia solitaria, sicca, acropleurogena, secedentia schizolytice, obpiriformia, papilla basilari praedita, levia, 2 (raro 1) septis transversalibus praedita, fusca vel brunnea, colore mutabilia, 15–26 (20.6) $\times$ 7.5–5.5 (6.5) μm . Cellula proximalis, 8.5–13.5 (10.7) μm longa et 5.5–7.5 (6.5) μm crassa, omnino ceteris obscurior, cicatrice

basilari 1.7–2.7 (2.1) μm *crassa praedita*. *Conidia* interdum sursum proliferentia et falsos ramos producentia.

In ligno putrido Pistaciae lentisci, in loco "Il Volterraio", Isola d'Elba (Livorno) in Italia, 4.8.1990, legit D. Lunghini, HOLOTYPUS: ROHB 184.

Additional specimen: on dead wood of *Phillyrea latifolia*, W.W.F. reserve, Macchiagrande (Focene, Roma) Italia, 15.11.1992, legit F. Pinzari, ROHB 185.

Etym.: from Latin term "*dumetum*", i.e. the underbrush environment where the species has been found.

Colonies effuse, brown to reddish brown, setose.

Mycelium principally immersed in the substratum, composed of branched, septate, smooth, yellowish brown, up to 2.5 μm thick hyphae, swollen at times.

Conidiophores macronematous, mononematous, caespitose at times, unbranched, erect, straight or flexuous, smooth, brown, paler towards the apex, 6–10-septate, 130–350 (192) $\times$ 3.8–5.7 (5.1) μm , with a swollen base up to 15 μm wide.

Conidiogenous cells integrated, terminal or intercalary, polyblastic, sympodial, bearing slightly thickened, pale, and barely discernible scars.

Conidia solitary, dry, acropleurogenous, obpyriform, smooth, with 2, seldom 1, transverse septa, brown to reddish brown, 15–26 (20.6) $\times$ 5.5–7.5 (6.5) μm , with the basal cell darker than the others, 8.5–13.5 (10.7) μm long, bearing a papillar 1.7–2.7 (2.1) μm wide scar at the proximal end.

Some mature conidia can proliferate at the apex and produce new conidia. We describe this phenomenon as a false branching; a new conidiogenous locus is produced from the conidial apex, when the conidium, instead of seceding, remains in contact with the conidiogenous cell. This can be possibly ascribed to a high level of moisture occurring during the fructification (Gams, pers. comm.).

An attempt to obtain this species in pure culture was unsuccessful.

Pseudospiropes dumeti agrees with the generic concept of *Pseudospiropes* M.B. Ellis (Ellis, 1971; Iturriaga & Korf, 1990) on the basis of all the characteristics examined. Furthermore, *Pseudospiropes dumeti* differs from the related genus *Spiropes* Ciferri because of its strictly saprophytic habit, and indeed it has never been found in association with other fungi. Notwithstanding the similarity in the form of conidia, we would not include this species in either *Pyriculariopsis* M.B. Ellis, or *Pyricularia* Sacc., the former showing denticulate conidiophores and the latter having conidia seceding rhexolytically (de Hoog & Van Oorschot, 1985).

Within the genus *Pseudospiropes* our species presents affinities with several other species, also bearing barely discernible scars, but it can be easily recognized by the obpyriform conidia, typically biseptate when mature. Actually *P. elaeidis* (Steyaert) Deighton (Deighton, 1985), *P. falcatus* Morgan-Jones (Morgan-Jones, 1977) and *P. rousseianus* (Mont.) M.B. Ellis show pale, thin-walled, fusiform to subcylindrical pluriseptate conidia. *P. lotorum* Morgan-Jones (1977) and *P. leptotrichus* (Cooke & Ellis) M.B. Ellis usually have triseptate pale conidia; *P. hughesii* M.B. Ellis, the *Pseudospiropes* state of *Melanomma subdispersum* (P. Karst.) Berl. & Vogl., *P. subuliferus* (Corda) M.B. Ellis, *P. novae-zelandiae* S. Hughes, *P. variabilis* S. Hughes and *P. obscurus* Matsushima (1983) have 3–4-septate ellipsoidal or subcylindrical,

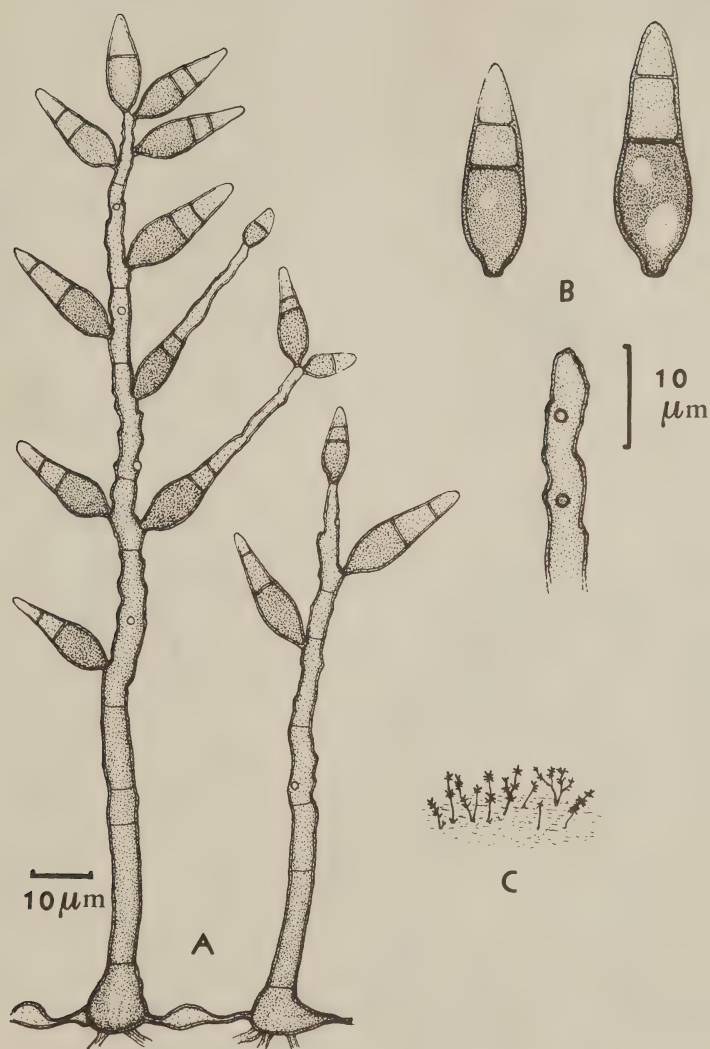


Fig. 1. *Pseudospiropes dumeti*. **A** - Conidiophores and conidia; **B** - Conidia and a detail of the conidiophore apex; **C** - A colony on its natural substratum.

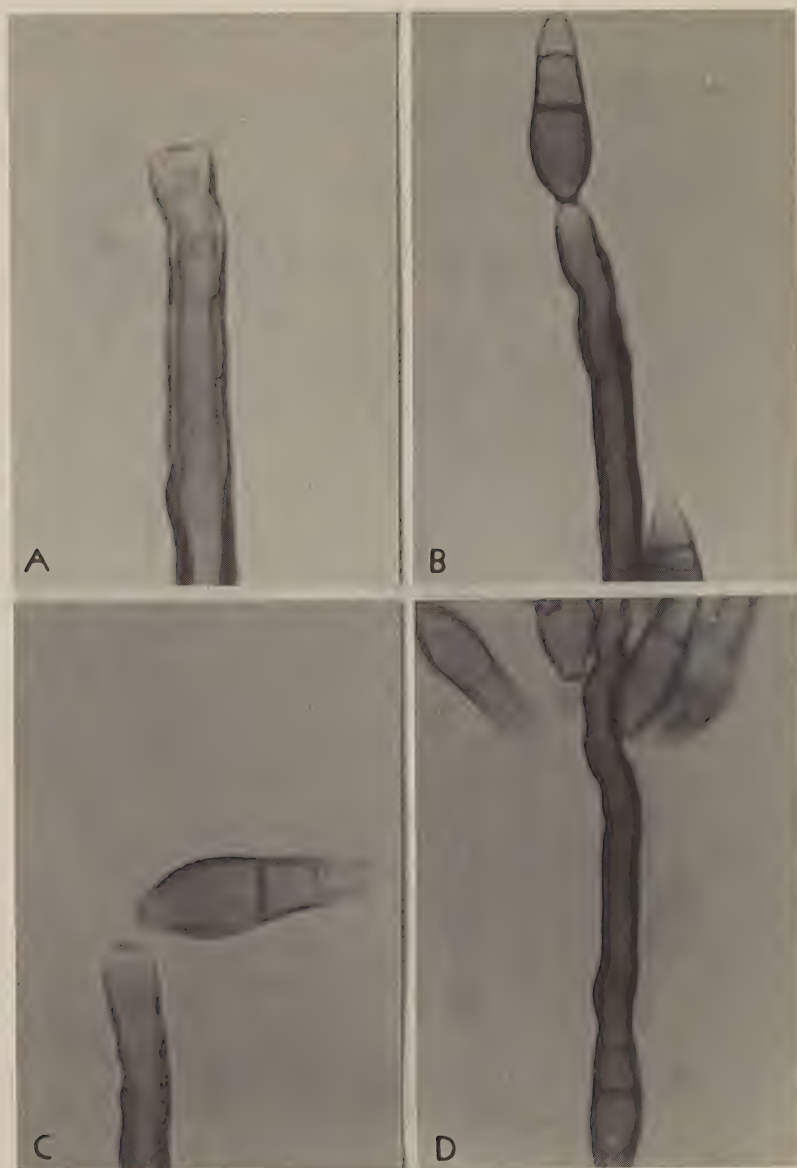


Fig. 2. *Pseudospiropes dumeti*: A - Detail of the conidiophore apex ($\times 1900$), B, C - Conidiophore apex with conidia (B $\times 1300$, C $\times 1550$), D - Detail of a false branch ($\times 1150$).

usually slightly pigmented conidia. *P. navicularis* Castañeda (1987) has 3-rarely 2-septate, navicular conidia. *P. pinarensis* Castañeda (1988) has triseptate, catenate, slightly pigmented conidia and *P. verruculosus* (P.M. Kirk) Sivanesan & B. Sutton (Sivanesan & Sutton, 1985) has small, rough conidiophores and distoseptate, subconical conidia with a large truncate base.

The authors are indebted to Dr L. Mezzana for correcting the Latin diagnosis, to Dr A. Pavesi (Rome) for classification of substrata, to Prof. W. Gams and Prof. G. S. de Hoog for reviewing the manuscript and to the Museo Provinciale di Storia Naturale (Livorno) for the invaluable cooperation offered. This research was supported by a grant from M.U.R.S.T. (Ministero dell'Università e della Ricerca Scientifica e Tecnologica).

REFERENCES

- Castañeda Ruiz, R.F.** (1987). Fungi Cubenses II. Instituto de Investigaciones Fundamentales en Agricultura Tropical "A. de Humboldt". Cuba, 21 pp.
- Castañeda Ruiz, R.F.** (1988). Fungi Cubenses III. Instituto de Investigaciones Fundamentales en Agricultura Tropical "A. de Humboldt". Cuba, 25 pp.
- Deighton, F. C.** (1985). Three leaf-spotting Hyphomycetes on palms. *Trans. Br. mycol. Soc.* 85: 739-742.
- Ellis, M.B.** (1971). Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, 608 pp.
- Ellis, M.B.** (1976). More Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, 507 pp.
- Holubová-Jechová, V.** (1973). Lignicolous Hyphomycetes from the Netherlands. *Proc. Konin. Ned. Akad. Wetensch.*, Amsterdam, Sect. C 76 (3): 297-302.
- de Hoog, G.S. & Van Oorschot, C.A.N.** (1985). Taxonomy of the *Dactylaria* complex IV-VI. *Stud. Mycol.* 26: 1-124.
- Hughes, S.J.** (1989). New Zealand Fungi, 33. Some new species and new records of dematiaceous Hyphomycetes. *New Zealand J. Bot.* 27: 449-459.
- Iturriaga, T. & Korf, R.P.** (1984). Studies in the genus *Strossmayeria* (Helotiales). 4. Connection to its anamorph, *Pseudospiropes*. *Mycotaxon* 20: 179-184.
- Iturriaga, T. & Korf, R.P.** (1990). A monograph of the Discomycete genus *Strossmayeria* (Leotiaceae), with comments on its anamorph, *Pseudospiropes* (Dematiaceae). *Mycotaxon* 36: 383-454.
- Matsushima, T.** (1983). Mycological Memoirs, 3. Kobe, Japan, 89 pp.
- Morgan-Jones, G.** (1977). Notes on Hyphomycetes, XVII. A new species of *Pseudospiropes*. *Mycotaxon* 5: 481-483.
- Morgan-Jones, G.** (1982). Notes on Hyphomycetes XLII. New species of *Acrodictys* and *Pseudospiropes* from South Africa. *Mycotaxon* 16: 187-191.
- Sivanesan, A. & Sutton, B.C.** (1985). Microfungi on *Xanthorrhoea*. *Trans. Br. mycol. Soc.* 85: 239-255.

MYCOTAXON

Volume LVIII, pp. 349-351

April-June 1996

TWO MORE SPECIES OF AMPHISPHAERIA (XYLARIALES)

MARGARET E. BARR

9475 Inverness Road, Sidney, British Columbia, Canada

V8L 5G8

and

ANNETTE W. RAMALEY

7 Animas Place, Durango, Colorado 81301-4339 USA

ABSTRACT

Amphisphaeria seriata and *A. foveata* are newly described.

Two species of *Amphisphaeria* were found among the interesting fungi that occur in leaves of genera in the Agavaceae, specifically in *Nolina*. These taxa do not appear to have been described, and are presented to science in this contribution.

Among the species that Barr (1989, 1994) recognized in *Amphisphaeria*, *A. bufonia* (Berk. & Broome) Ces. & De Not., *A. multipunctata* (Fuckel) Petr., and *A. umbrina* (Fr.) De Not. form discoid, amyloid apical rings in the asci. *Amphisphaeria pardalina* (Ellis & Everh.) M.E. Barr and *A. serrulata* (Ellis & G. Martin) M.E. Barr both form cubical (4.5-6 μm wide, 3-4 μm high), amyloid, apical rings in the asci, as does *A. striatispora* Cand. & Katum. (3-4 μm wide, 2-2.5 μm high) (Candoussau et al. 1985). The asci of *A. arizonica* M.E. Barr contain nonamyloid apical rings. Ascospore ornamentation also varies among these species: lacking in *A. umbrina* and *A. multipunctata*; lacking but with pallid terminal slits in *A. pardalina*; finely foveolate in *A. bufonia*; forming longitudinal striae in *A. arizonica*, *A. serrulata*, and *A. striatispora*. The two species described herein also differ in details of the amyloid apical rings, one discoid, the other tubular, and in their ascospore ornamentation.

Amphisphaeria seriata M.E. Barr & A.W. Ramaley, sp. nov.
Figs. a-d

Ascomata gregaria immersa vel erumpentia globosa 300-400 μm diametro clypeata papillata. Asci unitunicati 125-150 x 12-16 μm cylindrici paraphysati, annuli apicales amyloidei discoidei 1-1.5 μm alti. Ascosporae 15-20 x 6-8 μm spadiceae ellipsoideae fusoidae uniseptatae foveolatae uniseriatae.

Holotypus in foliis *Nolinae* sp., "USA: Texas: Gillespie Co., Enchanted Rock State Park, 23 Oct 1993," a A.W. Ramaley n. 9330 lectus in BPI sub n. 802953 depositus.

Ascomata globose, 300-400 μm diam, gregarious in rows, immersed separately beneath blackened clypei; short apical papillae to surface, ostiole periphysate; peridia light brown, narrow, of compressed rows of cells, apically darkened by small hyphal clypei. Asci 125-150 x 12-16 μm , cylindric, peripheral; apical ring refractive, discoid, 1-1.5 μm high, amyloid. Paraphyses 2-3 μm wide, guttulate, distantly septate. Ascospores 15-20 x 6-8 μm , clear dark brown, ellipsoid fusoid, uniseptate, slightly constricted; wall finely foveolate, deeply pigmented at septum and at times at tips, surrounded by gel coating 2-5 μm wide, compacted to 1-1.5 μm over smooth wall surface; single globule per cell; uniseriate in the ascus.

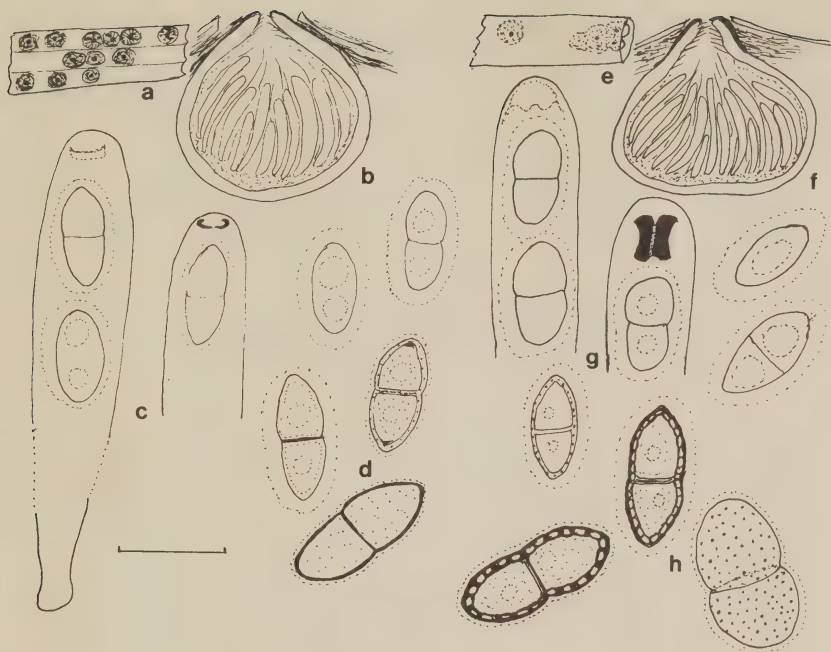
Known from the type collection and from Texas: Brewster Co., Big Bend National Park, 25 Oct 1994, A.W. Ramaley n. 9444A, deposited in UC; also in small numbers in many collections of the host plant.

Amphisphaeria foveata M.E. Barr & A.W. Ramaley, sp. nov.
Figs. 3-h

Ascomata gregaria immersa globosa vel ovoidea 399-400 μm lata 400-500 μm alta, clypeata maculata 1-3 mm longa. Asci unitunicati 130-150 x 14-15 μm cylindrici paraphysati, annuli apicales amyloidei tubularis 3-4 μm lati 4-5 μm alti. Ascosporae 16-20 x 8-10 μm umbrinae ellipsoidei uniseptatae foveatae uniseriatae.

Holotypus in foliis *Nolinae* sp., "USA: Texas: Culberson Co., Guadalupe Mountains National Park, near the Frijole Ranch Trailhead, 26 Oct 1994," a A.W. Ramaley n. 9431A lectus in BPI sub n. 802952 depositus.

Ascomata globose or ovoid, 300-400 μm wide, 400-500 μm high including short papillae, separate or two to three beneath grayish brown clypeus, forming blotches ca. 1 mm or when grouped 2-3 mm long; papillae short, ostiole periphysate; peridia narrow, light brown, of compressed rows of cells, apically darkened by small hyphal clypeus. Asci 130-150 x 14-15 μm , cylindric, peripheral; apical ring refractive, tubular, 3-4 μm wide, 4-5 μm high, amyloid. Paraphyses 3-4 μm wide, guttulate, distantly septate. Ascospores 16-20 x 8-10 μm , dark brown, broadly



Amphisphaeria spp. from *Nolina*. a-d. *A. seriata*, e-h. *A. foveata*. a, e, habit sketches, not to scale. b, f, ascomata in section, standard line = 150 μ m. c, asci and d. ascospores, standard line = 15 μ m.

ellipsoid, uniseptate, constricted at maturity; wall thickened, foveate, surface aspect of numerous warts, surrounded by gel coating, 2-3 μ m wide, compacted to 1 μ m over smooth wall surface; single globule per cell; uniseriate in the ascus.

Known only from the type collection.

Acknowledgments. We thank the Park Services at Guadalupe Mountains National Park and Big Bend National Park for permission to collect these and other specimens. We thank Dr. C. T. Rogerson for reviewing the manuscript.

LITERATURE CITED

- Barr, M.E. 1989. Some unitunicate taxa excluded from *Didymosphaeria*. *Stud. Mycol. Baarn* 31: 23-27.
- , 1994. Notes on the *Amphisphaeriaceae* and related families. *Mycotaxon* 51: 191-224.
- Candoussau, F., K. Katumoto, and M. Sherwood-Pike. 1985. Bambusicolous fungi from the southwest of France I. Two new species of pyrenomycetes and a new genus of the *Phacidiaceae*. *Sydowia* 38: 28-34.

AN ANALYSIS OF WORKS OF, AND UPON, CURTIS GATES LLOYD

WILL H. BLACKWELL AND MARTHA J. POWELL

Department of Biology, James Madison University,
Harrisonburg, Virginia 22807

ABSTRACT

Curtis Gates Lloyd (1859-1926) was an important and somewhat unconventional American mycologist. We have studied C.G. Lloyd's publications and research notes curated in the Lloyd Library, Cincinnati, Ohio. Only brief exposés of his life have been found, and the purpose of this study is to appraise his potential impact on modern systematic views. Lloyd's contributions to mycology, including his seven volumes of *Mycological Writings*, his "mycological wit," and a 59,000 specimen fungal herbarium, are substantial. His collection of photographs of mycologists as well as his photographic representation of fleshy fungi are exceptional. However, Lloyd's strong opinions on nomenclature, against citing the author of fungal names, and against the generally obligatory principle of nomenclatural priority, have not found their way into the *International Code of Botanical Nomenclature*. Despite his lobby against the proliferation of new species names, Lloyd published over a thousand new names of fungi. His descriptions of many kinds of macroscopic fungi, especially Gasteromycetes, are widely cited, indicating his continued impact on mycology. Lloyd successfully promoted American mycological literature internationally through his voluminous mycological correspondence. His legacy persists in numerous components of the unique Lloyd Library, and in several natural areas donated to science.

NARRATIVE

Rogers (1981) made reference to a biographer of the renowned mycologist, Curtis Gates Lloyd (1859-1926). However, only short articles (Fitzpatrick, 1927; Simons, 1951) or brief parts of publications (Mayo, 1928; Simons, 1972; Rogers, 1981; Tyler and Tyler, 1987; Campbell, 1991; Korf, 1991) could be found on Lloyd. These publications are largely anecdotal, in some cases sparsely referenced and, with the partial exception of Fitzpatrick (1927), contain but limited analysis of Lloyd's actual work in and contributions to mycology. The present paper focuses upon Lloyd's mycological studies, viewpoints, and items of interest centering around these, with no special attempt to review information about his life which has previously been published.

C.G. Lloyd's contributions to mycology, including his seven volumes of *Mycological Writings* (the flagrant pagination irregularities withstanding), his unprecedented correspondence with other mycologists of the world, and his famous "mycological wit" (e.g., Fig.1), are substantial indeed. However, some points of "credit" deserve further scrutiny. Simons (1951) believed that "many of his ideas [on nomenclature] have been adopted by the International Botanical Congress." On the contrary, Lloyd's strong opinions on botanical nomenclature, i.e., against citing the author(s) of plant (and fungal) names (a practice which he considered "personal advertisement"), and also against the legislated protocol of name priority (cf. Lloyd, 1902a), have not stood the test of time. Lloyd believed that botanical nomenclature was much like a language and that its usage should evolve naturally as such, without "artificial" rules and regulations. He felt that adherence to the principle of nomenclatural priority could result in the overturning of well-known names, in favor of poorly known earlier names, a practice he unflatteringly labelled "name juggling" (Lloyd, 1904a). Lloyd (1910a) believed that the designation of "type

species" in a genus potentially led to "name juggling." However, he (1904b) viewed the type specimen of a species as it is properly viewed today, simply as an "authentic and true specimen of the species." Lloyd (1910b) was essentially in accord with Farlow and Atkinson's proposal for later starting point dates for fungal nomenclature (Pfister, 1981), this proposal being adopted at the Brussels Botanical Congress in 1910.

Despite his long-term lobby against the proliferation of new species by taxonomists (e.g., Lloyd, 1907a), and against affixing of the names of the authors to species names, Lloyd published over a thousand new species names of fungi. Although representing careful scholarship, authorship was usually not indicated, and it became necessary for other workers to laboriously ferret out such names from his literature (Stevenson and Cash, 1936). Lloyd's publication of some of these taxa under the pen name, "N.J. McGinty," further complicated the situation. Some of these "McGinty names" are probably to be taken seriously (Lloyd, 1922a), and others probably not (Lloyd, 1910c, 1913a). Since it was not always possible to decide with certainty, the McGinty names are usually included in lists of species attributed to Lloyd (cf. Stevenson and Cash, 1936). McGinty names or combinations have occasionally surfaced, nomenclaturally legitimized, e.g. the name for conidial peat mould, *Chromelosporium fulvum* (Link) McGinty, Hennebert & Korf in Hennebert and Korf (1975). *McGintya*, a journal emphasizing "unusual and mysterious discoveries in mycology and related fields," began with its first issue in August, 1994, dedicated to "Professor N.J. McGinty."

Lloyd was free with his criticism of the work of other mycologists and, when he believed it warranted, stated his opinions candidly, regardless of the circumstances. As a case in point the reader is referred to Lloyd's less than guarded comments concerning the superficiality of the Australian work of the British mycologist, Dr. Mordecai C. Cooke, these

remarks being composed shortly after Dr. Cooke's death (Lloyd, 1915a). Lloyd's opinions varied greatly about certain mycologists over time, turning rapidly in some cases from praise to ridicule (see Korf, 1991, concerning Lloyd's remarks on Elias Durand). In his latter work, Lloyd occasionally employed the sardonic visage (see interpretation of Fitzpatrick, 1927) of the little Oriental God, Tso Kay, as an inset imprint into brief articles (see Lloyd, 1924a) in which he attacked "hypocrisy" in mycological work. This "hypocrisy" usually involved matters of priority and "name juggling." E. A. Burt, a worker in resupinate Thelephoraceae, and a strict prioritist, became a favorite target for the Tso Kay image (Lloyd, 1924b). Lloyd (1924c) even inferred the possibility of an influence of Tso Kay's "sayings" on a perceived improvement in Burt's work. Although Lloyd could be unmercifully critical of others, it is only fair to say that Lloyd was equally critical of his own work throughout his career, as exemplified by the title of his Mycological Note no. 185, "An Inexcusable Blunder." In this brief article (1902b), he chides himself harshly for writing down an incorrect species name in his "Genera of Gastromycetes," published the same year. Regarding caustic commentary, Lloyd, who had a flair for composing titles of articles, was the author of a number of amusing and sometimes acrid short publications, such as "Logic of a Name Juggler" (1905a), "A Possible Mistake in Japan" (1908a), "What a Long Tail Our Cat Does Have!" (1910d), "Another 'fungus' Gone Wrong" (1911a), and "Speaking of Bulls!" (1923), in which he criticized the work or ideas of one person or another, including himself. Lloyd's intolerant side showed in his opinion of student theses (Lloyd, 1921a), which he considered (typically, anyway) as "the pests of the librarian" and "a waste of time and printer's ink."

Regardless of outspoken remarks, C.G. Lloyd's original descriptive contributions on macroscopic fungi are significant. Curtis' initial work (e.g., J.U. & C.G. Lloyd, 1885-86) was with his brother (famous pharmacognocist John

Uri Lloyd) on medicinal angiosperms (an effort related to the family business). However, in the early 1890s Curtis turned his scientific attention almost exclusively to fungi. C.G. Lloyd's publications on fungi began in the late 1890s, dealing at first with agarics such as the "*Volvae*" (1898a), *Lepiota* (1898b), *Psalliota* (1899), and *Collybia* (1900). Lloyd (1898a) pointedly stated that "there are hundreds of botanists in the United States going over the same old ground year after year, flowering plants, when a practically unexplored field [fungi] lies at their very doors" and that "the study of the larger fungi, especially Agarics, is suffering for want of careful workers..." Lloyd received early recognition for his work, as attested by the brief but favorably phrased review article by Bessey (1898) discussing Lloyd's contribution to knowledge of the *Volvae* (*Amanita* and *Volvaria*).

Rather swiftly though, Lloyd switched his primary interest from agarics to Gasteromycetes, beginning with his published plea (1901a) to "Save Your Puffballs." This was followed by detailed descriptive works on puffballs and earthstars (e.g., Lloyd, 1902c, 1902d, 1903, 1905b, 1907b) and also bird's-nest fungi (Lloyd, 1906a). Subsequently, Lloyd (1908b) issued the call to "Observe Your Phalloids," including instructions to readers on sketching, photography (if possible), drying, and mailing of phalloid specimens. This was followed by Lloyd's (1909) extensive publication on phalloids; the illustrations in this publication (some are drawings and some are photographs) are well worth a careful look by any investigator of phalloid systematics; the source of a number of the illustrations is, however, unclear. Coker and Couch (1928) accorded Lloyd ample credit for the substance of his contribution to knowledge of Gasteromycetes. If one were to select one major group of fungi to associate with the efforts of C.G. Lloyd, it would surely be the Gasteromycetes.

Although not losing his interests in the Gasteromycetes, Lloyd again shifted emphasis to an extent, this time to polypores (e.g., Lloyd 1910e, 1911b, 1912, 1915b) and also

thelephoraceous fungi (e.g., Lloyd, 1913b). However, during the latter part of his active career, Lloyd devoted his attention primarily to some of the larger Pyrenomycetes (Lloyd, 1917a), especially *Cordyceps* (e.g., Lloyd, 1915c, 1920) and *Xylaria* (e.g., Lloyd, 1918, 1924d, 1924e), and also to certain Discomycetes (e.g., Lloyd, 1916a). Hence, Lloyd's work shows, though not in an all-or-none fashion, something of a transition from work on fleshy Basidiomycetes (first agarics, then Gasteromycetes and polypores) to the study of fleshy or indurated Ascomycetes. That this transition was at least somewhat formulated in Lloyd's mind seems clear from his statement to his readers (1917b) regarding the kinds of specimens which he wished to receive: "All are desired excepting specimens of fleshy Agarics." Hence, by 1917, Lloyd planned no further work on mushrooms *per se*.

In his mycological taxonomic work, Lloyd (1904c) believed in use, but not overuse, of what is seen through the microscope in determining taxonomic boundaries and relationships. Lloyd felt that, for example, basidial characters were difficult to utilize as primary characters in many Gasteromycetes since such features were visible only in the young stages of the fungus. In this regard, Lloyd was opposed to the scheme of classification proposed (by Fischer) in Engler and Prantl (cf. Lloyd, 1902c). Nonetheless, Lloyd's work, as exemplified by his (1902c) work on Gasteromycetes, occasionally contained some illustration (photomicrograph or drawing) of spores of the organisms as viewed through a microscope. In fact, Lloyd (1902e) provided a clear statement of his uniform method of photomicrography of spores of Gasteromycetes, so that spore dimensions could be readily ascertained by his readership.

Regardless of views on the value of microscopic detail, Lloyd's taxonomic work was underpinned by years of study of type material in major European herbaria. His massive and admirable treatment of phalloids (Lloyd, 1909) was accompanied by a list of species in major museums such as

Kew, the British Museum, Paris, Upsala, and Berlin. Lloyd communicated notes of some of his travels to his readership (e.g., Lloyd, 1904d). Lloyd's work was bolstered not only by his extensive visits to Europe, but also by travel to tropical regions such as Samoa (Fig. 2); Lloyd visited Samoa on at least two occasions (see Lloyd, 1909, pg. 74). Lloyd published one brief article on "fungi" of Samoa (1911c), an account of the Myxomycetes he collected there (these being determined by "Professor Macbride"). Lloyd was not especially fond of Myxomycetes, and in another brief publication (1921b) stated that, reluctantly, "I have had to study them a little." An occasional brief allusion to Samoan fungi is to be found in other Lloyd publications (e.g., Lloyd 1909, pgs. 18, 74). However, Lloyd was enriched by his Samoan experience far beyond what might be indicated by his publications. An unpublished photo album of his 10-week stay in Samoa (Winter of 1899-1900) resides in the Lloyd Library, Cincinnati, and provides a fascinating record of this trip, in which he was influenced not only by the plants and fungi, but by the people. In addition to his own travels, Lloyd's voluminous correspondence brought specimens from around the world to his attention, and hence his (Lloyd, 1907a) global view of the fungal flora, and stated opposition to the creation of new species, which might actually be fungi already known in another country (see also Lloyd, 1906b). As we can determine, Lloyd provided some of the foundation

FIGURES. 1-4: 1. Seasonal greeting card distributed by C.G. Lloyd, January, 1907, illustrative of his keen wit; the two sides, both featuring photographs of Curtis, are labelled respectively: "Before the Study of Fungi, 1880" and "After the Study of Fungi, 1906." 2. Photograph of C.G. Lloyd with native Samoan Islanders during his 10-week stay in Samoa, Winter, 1899-1900. 3. Present day Lloyd Library building, 917 Plum Street, downtown Cincinnati, Ohio. 4. Puffball (*Lycoperdon*), one of the photographs comprising Lloyd's "Photogravure of American Fungi."



2

Mr. Levi Salpica

Before the Study of Fungi

After the Study of Fungi



1

1880



1906



4



3

of modern mycogeographic thought, taking into careful account similarities and differences of particular kinds of fungi from different parts of the world (e.g., Lloyd, 1916b), and as well the host materials on which they occurred.

Perhaps underestimated contributions of C.G. Lloyd's are his many exceptional macroscopic photographs (or to use his term "photogravure") of a great variety of fleshy fungi. In the years between turning his attention fully to the study of fungi, early 1890s, and the time he assumed the competence to publish upon them, late 1890s, he took hundreds of photographs of fresh or well preserved material (see "Introduction," 1898c), a practice which he continued virtually to the end of his life. Although Lloyd considered his photography to represent no special skill (or as he put it, to be "largely mechanical"), most of his photomicrographs of fleshy fungi are of high quality and are to be found throughout his mycological writings. A bound set of 32 photographs, the so-called "Photogravure of American Fungi" *per se*, was apparently not formally published as a unit, but is available for examination at the Lloyd Library (Fig. 3) in Cincinnati (We note that Simons, 1951, considered this set to be "published," and, indeed, publication is a matter of definition). Many mycological photographs (e.g., Fig. 4), published and unpublished, are available at the Lloyd Library, some taken by C.G. Lloyd and others provided to him by collectors.

Seemingly even less appreciated are a substantial number of photographs and/or photographic reproductions of faithful portraits of C.G. Lloyd's mycological colleagues of various countries, and also of some of their predecessors. As was the case with specimens, some photos were taken by Lloyd, while others were sent to him for reproduction. Although Lloyd was generally complimentary of the individuals, their inclusion in his works fortunately was not necessarily determined by what he thought personally of them or their work. These reproductions appear to begin with the

inclusion of a portrait of the Rev. G. Bresadola in the front part of Volume 2 of *Mycological Writings*, a man with whom Lloyd carried on an extensive mycological correspondence. Other photographic reproductions include those of P.A. Saccardo (author of *Sylloge Fungorum*), A.P. Morgan (who introduced Lloyd to the study of mycology), Charles H. Peck (whom Lloyd considered "the father of systematic American mycology"), L.R. Tulasne (an earlier monographer of the Nidulariaceae), Professor George Masee (a curator of cryptogams at Kew), W.A. Kellerman (whom Lloyd felt had "succeeded in instilling new life into American mycology"), Emile Boudier ("the acknowledged master of French mycology"), Lars Romell (who had "the best knowledge of Swedish fungi"), W.G. Farlow ("Professor of Cryptogamic Botany at Harvard University," and originator of the "Bibliographical Index of American Fungi"), H.C. Beardslee (a man with "a critical knowledge of the Agarics"), the Rev. M.J. Berkeley (clergyman and pioneer English mycologist), Professor Roland Thaxter (Chair of Cryptogamic Botany, Harvard), Professor George F. Atkinson of Cornell (Lloyd was complimentary of Atkinson's introductory book on American mushrooms), and Elsie M. Wakefield ("the head of the mycological department at Kew Gardens," an expert on Thelephoraceae, and the only woman featured in Lloyd's series of portraits). Collectively, these and other likenesses provided by Lloyd stand today as a unique treasure-house of rare portraits of many of the founders of mycological science. As is evident, Lloyd added to the interest of these portraits by providing commentary in association with each, either as a figure legend or in a brief article.

C. G. Lloyd's personal fungal herbarium, estimated at 59,000 specimens (cf. Simons, 1972), is housed presently at the USDA in Beltsville, MD, after first being sent to the Smithsonian Institution. This large collection is unusual as an individual, yet world-wide, compilation. Lloyd's fungal herbarium is maintained today as a separate collection at the USDA (Mary Palm and Amy Rossman, personal

communication), and is available, apparently in its entirety, for perusal. However, some difficulty attends its study, since exsiccatae (lists of preserved specimens), common in many systematic collections, are generally absent from the Lloyd collection (Fitzpatrick, 1927). Lloyd (1914) considered exsiccatae to be often of relatively little value because so many specimens were "misnamed." Lloyd, in fact, did not personally collect the vast majority of these fungi; rather, they were sent to him by collectors and correspondents from around the world. Acknowledgement of receipt of these specimens from other collectors was frequently published in various of Lloyd's "Mycological Notes" (e.g., Lloyd, 1901b). Although better known for his mycological collection, C.G. Lloyd also amassed a phanerogamic plant collection of almost 30,000 specimens. This phanerogamic collection was obtained primarily by herbarium exchange, but also through Lloyd's own collecting efforts as a young man; it is housed at the University of Cincinnati, where it is on "long-term, interlibrary loan" (Simons, 1972).

Lloyd showed a keen appreciation of the history of mycology, and his place in it. His sensitivity to this history seems contradictory given his frequent refusal to cite authors or even references. The dearth of citation makes it difficult for the reader to trace the origin and historical context of various scientific names Lloyd employed in his works. Nonetheless, Lloyd's appreciation of his predecessors, and contemporaries, as regards his entrance into the field of mycology, is evident virtually from the outset of his mycological writings. These sentiments are clearly stated in his "Explanation" (1905c) placed at the beginning of *Mycological Writings*, Vol. 1, in which homage is paid to such prior workers as A.P. Morgan, G. Bresadola, and Professor Patouillard for their assistance to Lloyd in his becoming a mycologist. In one of his earliest unified works on Gasteromycetes, Lloyd (1902c) devoted a page to the topic of history of work on the group; in this, he makes certain to credit the efforts of previous workers such as "Peck,

Trelease, and Morgan." In the same vein, Lloyd (1906a) accorded Tulasne credit for laying the foundation of work in the Nidulariaceae. Lloyd (1909) gave Edward Fischer deference, including an excellent portrait photograph, for his knowledge of phalloids; and, in a similar manner, celebrated W.A. Murrill (Lloyd, 1915d) for coming "into prominence through his publication on the Polyporus." Lloyd's publications occasionally featured brief articles by other mycologists, e.g., Bourdot (1916), and earlier, Bresadola and Patouillard (1901) who named a thelephoraceous fungal genus after Lloyd, viz., "*Lloydella* Bres."

Lloyd (1898a) was acutely aware from the outset of the lack of a usable, accurate, and up-to-date literature of American mycology. Lloyd (1905d), in "advertising pages," continued to be cognizant and outspoken on how much nomenclature and other taxonomic matters had been "bungled," especially in American mycological work. Lloyd (1917c), who had taught himself a considerable measure of language facility while in other countries, wrote eloquently in a text passing between English and French (and in one passage, German), in his historically impressive "Myths of Mycology," on the rather primitive and undistinguished state of American mycology up to that point. It was through his many Mycological Notes and Letters mailed to correspondents over the years, essentially free of charge, that Lloyd would seem to have achieved his early implied objective (1898a) of promoting and upgrading, internationally, American mycological literature. Lloyd's mycological correspondence is curated at the Lloyd Library and Museum in Cincinnati, alphabetically arranged (personal communication, M.A. Flannery). A future biographer of C.G. Lloyd will be well served by this material.

Recent citations of Lloyd's work (e.g., Gilbertson and Ryvardeen, 1986-87; Ryvardeen, 1989), though not always totally complimentary (Ryvardeen, 1989), indicate nonetheless Lloyd's continued impact on mycology. A certain exception

should be taken with Ryvardeen's description of C.G. Lloyd as an "eccentric businessman," since Lloyd in 1905 retired from the family business to pursue full-time his mycological interests (Fitzpatrick, 1927), and his heart clearly was never in business affairs. That he was a man of means is not disputed, since, of the three Lloyd brothers, it was in large measure Curtis who built up the remarkable collection of books and journals housed in the Lloyd Library of Cincinnati, a unique combination of collections on mycology, botany, pharmacy, and entomology. The Lloyd Library contains the largest collection of Eclectic Medical books and journals in the world (Simons, 1972), many of course now rare and out of print. It was C.G. Lloyd's "Memorandum of Will" which provided the initial endowment for the library (M.A. Flannery, personal communication). C.G. Lloyd's legacy also persists in several sizeable natural areas that he gave to science, i.e., one near Crittenden, Kentucky (formerly C.G. Lloyd's farm), and three others, managed by Cornell University, in the vicinity of Ithaca, New York. (cf. Lloyd, 1925a; Fitzpatrick, 1927; Korf, 1991).

In 1922, four years prior to his death, Lloyd erected his own tombstone at Crittendon, Kentucky, bearing the inscription "Monument erected by himself for himself during his own life to gratify his own vanity. What fools these mortals be." This granite monument was intended by Lloyd as "a burlesque on tombstones in general" and a satire on mycologists who have passed "the Osler age" (Fitzpatrick, 1927). C.G. Lloyd died on November 11, 1926, at Bethesda Hospital in Cincinnati (Simons, 1951); he was 67 years old. During approximately the last three years of his life, Lloyd's mycological work was hampered by failing eyesight (Lloyd, 1924f). Nonetheless, he continued, loyally, to publish on specimens sent from his many correspondents (Lloyd, 1925b). In accordance with the dictates of his Will, his remains were cremated and dissipated (without ceremony); specifically, his ashes were scattered over the tombstone at Crittendon (Simons, 1951); he was not "buried" as seems to

be implied by Fitzpatrick (1927). Among other misconceptions perpetuated about C.G. Lloyd was that his works "laid the foundation for many new advances in medical mycology" (Simons, 1951). To the contrary, we have encountered only one article by Lloyd (Lloyd, 1904e) in which there was a focus on the medical efficacy of fungal material considered; and, even in this brief publication, he was perhaps less concerned with medicinal use than with proper pronunciation of the Native American (Piute) name for the puffball in question. C.G. Lloyd's mycological work is almost entirely taxonomic or mycogeographic in character. This is in contrast to his earlier work on medicinal properties of certain angiosperms, done primarily in collaboration with his brother, John Uri Lloyd, as previously discussed (see for example, J.U. and C.G. Lloyd, 1885-1886).

Part of the difficulty encountered in studying C.G. Lloyd's works is the ability to find various parts of them. His works occur as a number of notes, letters, bulletins, and pamphlets. The majority of these writings and associated photographs are bound in the seven volumes of *Mycological Writings*, but in the first five volumes there is often not a continuity of page numbers within or between volumes, obligating the reader in many cases to "thumb through" to find the article desired. Although the sequence of Lloyd's writings is difficult to follow, the search is made easier if the reader is aware of certain specific indices. The *Index to American Botanical Literature* (1969) contains a listing of 84 publications of C.G. Lloyd as sole or senior author (some Mycological Notes are combined under single listings), another three publications listed being coauthored with John Uri Lloyd (senior author). Not included or elaborated in this index, however, are many of the published letters and miscellaneous published notations of C.G. Lloyd; and some scientific writings of Lloyd are not published (but are still curated at the Lloyd Library). Some of Lloyd's "Puffball Letters" are published, bound toward the latter part of the first two volumes of *Mycological Writings*; however, it will

benefit both mycologist and biographer alike to know that a complete set of Lloyd's circulars on puffballs is collected at the Lloyd Library (M.A. Flannery, personal communication).

The most comprehensive index on Lloyd, is the "General Index to the Mycological Writings of C.G. Lloyd" developed by Stevenson (1933). Stevenson provided brief but useful commentary on the nature and mode of Lloyd's publications over the years, and their assembly into the seven volumes of *Mycological Writings*. Interestingly, Stevenson asserted that Lloyd's changing systematic viewpoints over the years made it impractical in the index to distinguish between recognized species and synonyms. Serious students of the works of Lloyd should avail themselves of Stevenson's index of Lloyd's mycological works. Also, Lloyd himself provided various types of indices (to taxa, subjects, contributors, etc.), bound usually at the beginning of each volume of *Mycological Writings*. All of the volumes of *Mycological Writings* are professionally printed by off-set, with the exception of volume six which is "in mimeographed form." Lloyd blamed the issuance of this volume by mimeograph on the "high cost of printing...in order to meet the arbitrary and unreasonable demands of organized labor..." (Lloyd, 1919). In volume six, a larger format size was also utilized. In volume seven, Lloyd went "back to the printers again" (Lloyd, 1922b), implying that the price of printing had dropped; however, the larger format size was retained. Despite what one might infer from such penny-pinching maneuvers, Lloyd was very generous with his readership throughout his career (e.g., Lloyd, 1917b), the subscription price to the many Mycological Notes he issued being "a little personal interest on the part of the recipient in picking up and sending to my address, specimens of the larger fungi." In this way, Lloyd was particularly successful in stimulating the growth of American mycological literature, interest in mycology, and the amplification of his own mycological herbarium. He involved many people in mycological study who otherwise might not have had their interest stimulated or recognized.

ACKNOWLEDGEMENTS

We are indebted to the following persons for their helpful and critical review of this manuscript: Dr. Richard T. Hanlin, Department of Plant Pathology, University of Georgia; Dr. Donald H. Pfister, Farlow Herbarium, Harvard University; and Mr. Michael A. Flannery, Director, Lloyd Library, Cincinnati, Ohio.

LITERATURE CITED

- BESSEY, C.E. 1898. A study of toadstools. *Science* (new series) 8: 587.
- BOURDOT, H. 1916. New *Porias* from France. *Mycological Writings*, Vol. 4, pg. 543 (out of sequence).
- BRESADOLA, G. and N. PATOUILLARD. 1901. Diagnoses of new species of fungi from Samoa. *Mycological Writings*, Vol. 1, pgs. 49-51.
- CAMPBELL, P. 1991. Cincinnati's hidden treasure: The Lloyd Library. *Cincinnati Museum of Natural History, Quarterly* 24(2): 8-12.
- COKER, W.C. and J.N. COUCH. 1928. *The Gasteromycetes of the Eastern United States and Canada*. The University of North Carolina Press, Chapel Hill. 201 pgs. (Dover reprint, 1974).
- FITZPATRICK, H.M. 1927. Curtis Gates Lloyd. *Mycologia* 19(4): 153-159.
- GILBERTSON, R.L. and L. RYVARDEN. 1986-87. *North American Polypores*, Vols. 1 & 2. Fungiflora, Oslo, Norway.
- HENNEBERT, G. L. and R.P. KORF. 1975. The peat mould, *Chromelosporium ollare*, conidial state of *Peziza ostracoderma*, and its misapplied names, *Botrytis crystallina*, *Botrytis spectabilis*, *Ostracoderma epigaeum* and *Peziza atrovinsoa*. *Mycologia* 67(2): 214-240.
- INDEX TO AMERICAN BOTANICAL LITERATURE, 1886-1966. 1969. Vol. 3, pgs. 85-87.
- KORF, R.P. 1991. An historical perspective: mycology in

- the departments of botany and of plant pathology at Cornell University and the Geneva Agricultural Experiment Station. *Mycotaxon* 40: 107-128.
- LLOYD, C.G. 1898a. A compilation of the Volvae of the United States. Pamphlet, reprinted in, *Lloydia* 23(4): 118-140, 1960.
- LLOYD, C.G. 1898b. The large Lepiotas. *Mycological Writings*, Vol. 1, pgs. 4-8.
- LLOYD, C.G. 1898c. Introduction. *Mycological Writings*, Vol. 1, pgs. 1-2.
- LLOYD, C.G. 1899. The genus *Psalliota*. *Mycological Writings*, Vol. 1, pgs. 25-30.
- LLOYD, C.G. 1900. Collybias of Cincinnati. *Mycological Writings*, Vol. 1, pgs. 33-44.
- LLOYD, C.G. 1901a. Save your "puffballs." *Mycological Writings*, Vol. 1, pgs. 56-58.
- LLOYD, C.G. 1901b. Acknowledgement of "puffballs" received. *Mycological Writings*, Vol. 1, pgs. 65-66.
- LLOYD, C.G. 1902a. Botanical nomenclature. *Amer. J. Pharm.* 74: 303-304.
- LLOYD, C.G. 1902b. An inexcusable blunder. *Mycological Writings*, Vol. 1, pg. 100.
- LLOYD, C.G. 1902c. The genera of "Gastromycetes." Reprinted as a 24 pg. section in *Mycological Writings*, Vol. 1.
- LLOYD, C.G. 1902d. The Geastrae. *Bull. Lloyd Libr.*, No. 5 (*Mycol. Ser.*, No. 2). 44 pgs. Bound as a part of *Mycological Writings*, Vol. 1.
- LLOYD, C.G. 1902e. Micro-photographs. *Mycological Writings*, Vol. 1, pg. 120.
- LLOYD, C.G. 1903. The Tylostomeae. *Mycological Writings*, Vol. 1, pgs. 133-136.
- LLOYD, C.G. 1904a. Nomenclature. *Mycological Writings*, Vol. 1, pgs. 169-170.
- LLOYD, C.G. 1904b. Types. *Mycological Writings*, Vol. 1, pg. 188.
- LLOYD, C.G. 1904c. N'abusez pas du microscope. *Mycological Writings*, Vol. 1, pgs. 177-178.

- LLOYD, C.G. 1904d. Notes of travel. Mycological Writings, Vol. 1, pgs. 157-164.
- LLOYD, C.G. 1904e. "Dza-Wahp-Abe-Sah." Mycological Writings, Vol. 1, pg. 188.
- LLOYD, C.G. 1905a. Logic of a name juggler. Mycological writings, Vol. 2, pgs. 242-243 (paging out of sequence).
- LLOYD, C.G. 1905b. The Lycoperdons of the United States. Mycological Writings, Vol. 2, pgs. 221-238 (out of sequence).
- LLOYD, C.G. 1905c. "Explanation". Mycological Writings, Vol. 1, pg. 4.
- LLOYD, C.G. 1905d. "Advertising Pages." Mycological Writings, Vol. 2, pgs. 26-28.
- LLOYD, C.G. 1906a. The Nidulariaceae or "bird's-nest fungi." Pamphlet of 30 pgs., bound as a part of Mycological Writings, Vol. 2.
- LLOYD, C.G. 1906b. The mycological situation in America. Mycological Writings, Vol. 2, Letter 10, pgs. 7-8.
- LLOYD, C.G. 1907a. New species. Mycological Writings, Vol. 2, pgs. 343-344 (out of sequence).
- LLOYD, C.G. 1907b. New notes on the Geasters. Mycological Writings, Vol. 2, pgs. 309-317 (out of sequence).
- LLOYD, C.G. 1908a. A possible mistake in Japan. Mycological Writings, Vol. 2, pg. 411 (out of sequence).
- LLOYD, C.G. 1908b. Observe your phalloids. Mycological Writings, Vol. 2, Letter 19, pg. 7.
- LLOYD, C.G. 1909. Synopsis of the known phalloids. Pamphlet of 96 pgs., bound as a part of Mycological Writings, Vol. 3.
- LLOYD, C.G. 1910a. The type species. Mycological Writings, Vol. 3, pg. 456 (out of sequence).
- LLOYD, C.G. 1910b. Our latest laws "by authority." Mycological Writings, Vol. 3, pgs. 478-479 (out of sequence).
- LLOYD, C.G. 1910c (writing as "N.J. McGinty"). A new genus *Aetnensis*. Mycological Writings, Vol. 3, pg. 460 (out of sequence).

- LLOYD, C.G. 1910d. What a long tail our cat does have!
Mycological Writings, Vol. 3, pg. 492 (out of sequence).
- LLOYD, C.G. 1910e. Synopsis of the genus "*Hexagona*."
Pamphlet of 46 pgs., bound as a part of Mycological Writings, Vol. 3.
- LLOYD, C.G. 1911a. Another "fungus" gone wrong.
Mycological Writings, Vol. 3, pg. 497 (out of sequence).
- LLOYD, C.G. 1911b. Synopsis of the section *Ovinus* of *Polyporus*. Mycological Writings, Vol. 3, pgs. 71-94 (out of sequence).
- LLOYD, C.G. 1911c. Myxomycetes of Samoa. Mycological Writings, Vol. 3, pg. 506 (out of sequence).
- LLOYD, C.G. 1912. Synopsis of the stipitate polyporoids.
Pamphlet bound (out of sequence) as pages 95-208 in Mycological Writings, Vol. 3.
- LLOYD, C.G. (writing as "N.J. McGinty"). 1913a. The species of the genus *Anthropomorphus* Seger.
Mycological Writings, Vol. 4, Letter 48, p. 11.
- LLOYD, C.G. 1913b. Synopsis of the stipitate Stereums.
Pamphlet bound (out of sequence) as pgs. 13-44 in Mycological Writings, Vol. 4.
- LLOYD, C.G. 1914. The named and misnamed specimens of the exsiccatae. Mycological Writings, Vol. 4., Letter 52, pgs. 1-29.
- LLOYD, C.G. 1915a. M.C. Cooke. Mycological Writings, Vol. 4, Letter 57, pgs. 1-4.
- LLOYD, C.G. 1915b. Synopsis of the genus *Fomes*.
Mycological Writings, Vol. 4, pgs. 209-288 (out of sequence).
- LLOYD, C.G. 1915c. Synopsis of the *Cordyceps* of Australasia. Pamphlet of 12 pgs., bound as a part of Mycological Writings, Vol. 4.
- LLOYD, C.G. 1915d. Synopsis of the section *Apus* of the genus *Polyporus*. Mycological Writings, Vol. 4, pgs. 289-392 (not in sequence).
- LLOYD, C.G. 1916a. The Geoglossaceae. Mycological Writings, Vol. 5, pgs. 1-22 (out of sequence).
- LLOYD, C.G. 1916b. Additional notes on *Cordyceps*.

- Mycological Writings, Vol. 5, pgs. 574-576, 591-594, 607-609. (Bound toward front of volume).
- LLOYD, C.G. 1917a. Synopsis of some genera of the large Pyrenomycetes. Pamphlet of 16 pgs., bound as a part of Mycological Writings, Vol. 5.
- LLOYD, C.G. 1917b. "Subscription price" (under Mycological Notes). Mycological Writings, Vol. 5, pg. 622 (not in sequence).
- LLOYD, C.G. 1917c. The myths of mycology. Pamphlet of 16 pgs., reprinted as a part of Mycological Writings, Vol. 5.
- LLOYD, C.G. 1918. *Xylaria* notes. Reprinted as 32 pg. section in Mycological Writings, Vol. 5. Contains taxonomic treatment of "The hollow Xylarias."
- LLOYD, C.G. 1919. Mycological Notes, No. 61 (untitled). Mycological Writings, Vol. 6, pg. 877 (follows pg. 16).
- LLOYD, C.G. 1920. The *Cordyceps* at New York Botanical Garden. Mycological Writings, Vol. 6, pgs. 912-913.
- LLOYD, C.G. 1921a. Theses. Mycological Writings, Vol. 6, pg. 1043.
- LLOYD, C.G. 1921b. Notes on the Myxomycetes. Mycological Writings, Vol. 6, pgs. 1039-1040.
- LLOYD, C.G. 1922a. Mycological Note No. 66 (see *Capitoclavaria capitata* McGinty). Mycological Writings, Vol. 7, pg. 1107.
- LLOYD, C.G. 1922b. "Back to the printers again." Mycological Writings, Vol. 7, pg. 1105 (follows pg. 14).
- LLOYD, C.G. 1923. Speaking of bulls! Mycological Writings, Vol. 7: 1211-1212.
- LLOYD, C.G. 1924a. Tso Kay. Mycological Writings, Vol. 7, pg. 1267.
- LLOYD, C.G. 1924b. Prof. Burt and his priority. Mycological Writings, Vol. 7, pg. 1288.
- LLOYD, C.G. 1924c. Burt's thirteenth paper. Mycological Writings, Vol. 7, pgs. 1323-1324.
- LLOYD, C.G. 1924d. Xylarias in the herbarium of Saccardo. Mycological Writings, Vol. 7, pgs. 1247-1249.

- LLOYD, C.G. 1924e. Miscellaneous species of *Xylaria*. Mycological Writings, Vol. 7, pgs. 1249-1253.
- LLOYD, C.G. 1924f. The personal situation. Mycological Writings, Vol. 7, pg. 1262.
- LLOYD, C.G. 1925a. Gives 436-acre wildflower and nature preserve. Mycological Writings, Vol. 7, pg. 1346-1347.
- LLOYD, C.G. 1925b. Noteworthy specimens received from correspondents. Mycological Writings, Vol. 7, pgs.1350-1364.
- LLOYD, J.U. and C.G. LLOYD. 1885-86. Drugs and Medicines of North America, Vol. 1. Ranunculaceae. Robert Clark & Co., Cincinnati, Ohio. 304 pgs.
- MAYO, C.A. 1928. The Lloyd Library and its makers, an historical sketch. Bull. Lloyd Libr., No. 28. 72 pgs.
- PFISTER, D.H. 1981. Atkinson, Farlow, and the later starting point debate. Occas. Pap. Farlow Herb.16: 129-136.
- ROGERS, D.P. 1981. A Brief History of Mycology in North America. Mycological Society of America. 86 pgs.
- RYVARDEN, L. 1989. Type studies in the Polyporaceae--21. Species described by C.G. Lloyd in *Cyclomyces*, *Daedalea*, *Favolus*, *Fomes* and *Hexagonia*. Mycotaxon 35(2): 229-236.
- SIMONS, C.M. 1951. Curtis Gates Lloyd, Mycologist. Nat. Eclectic Med. Quart. 43(1): 13-16; 43(2): 11-14.
- SIMONS, C.M. 1972. Lloyd Library. Cincinnati J. Med. 53: 185-188.
- STEVENSON, J.A. 1933. General index to the mycological writings of C.G. Lloyd, 1898-1925. Bull. Lloyd Libr., No. 32 (Mycol. Ser., No. 7). 64pgs.
- STEVENSON, J.A. and E.K. CASH. 1936. The new fungus names proposed by C.G. Lloyd. Bull. Lloyd Libr., No. 35 (Mycol. Ser., No. 8). 209 pgs.
- TYLER, V.E. and V.M. TYLER. 1987. John Uri Lloyd. J. Nat. Prod. 50(1): 1-8. (Notation on C.G. Lloyd on pg. 6).

MYCOTAXON

Volume LVIII, pp. 375-385

April-June 1996

NEW REPORT OF LICHENS FROM SOUTHERN AFRICA

C.M. THOMAS

Department of Education, Umtata, South Africa

R.B. BHAT

Department of Botany, University of Transkei, Private Bag XI, Umtata, South Africa

ABSTRACT

Eighteen species of lichens of the family Pyxinaceae (5), Parmeliaceae (4), Collemaceae (3), Usneaceae (1), Lecideaceae (1) Diploschistaceae (1), Cladoniaceae (1), Ramalinaceae (1) and Physciaceae (1) reported for the first time from South African floristic region and are new records for southern Africa. The present paper is the second of the series of lichenological exploration of Transkei region and provides additional information to the previous reports. Ecology, distribution and morphological characters are discussed. Some lichens occur only in the coastal regions while some others are found only at high altitudes, therefore, these can be termed coastal lichens and mountain lichens respectively. Two terricolous lichens Baeomyces and Toninia are colonizers of bare exposed substratum that is liable to constant erosion.

INTRODUCTION

Carl Linnaeus was the first biologist to record lichens from South Africa. Since 1770, many others have attempted to work on lichen communities of southern Africa, although only in recent years has increased interest developed in the various aspects of Lichenology. Doidge (1950) compiled a complete list of all lichens reported from southern Africa up to 1945. Considerable advancement in lichen taxonomy, anatomy and phytochemistry have been achieved in the last two decades. Important aspects such as lichen distribution, pollution monitors, phytosociology, and pharmacology are yet to be established (Thomas and Bhat, 1995).

MATERIALS AND METHODS

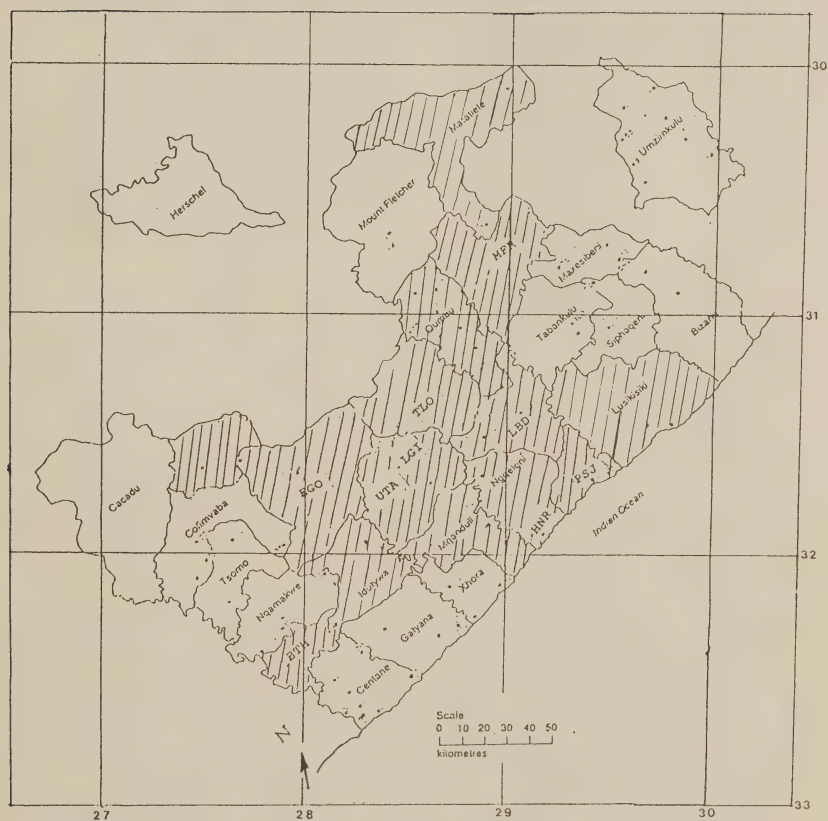
The new report of lichens is based on the collections and study made by the authors in 1993 from different parts of Transkei region of South Africa (see map of Transkei). All these collections were made from the sea level to 1800 meters. The localities visited, their code and altitude are given in the Table 1. Three identical series of voucher specimen lichens were made from the collections and deposited in the herbarium of the department of Botany, University of Transkei (KEI), and in private herbarium of the two authors. In the floristic list, each species is provided with a short note on its morphology, ecology, and distribution. Abbreviations and the number indicate the recording system of the voucher specimens in the herbarium.

ECOLOGY

Southern Africa includes the areas such as Lesotho, Swaziland, Botswana, Namibia [South West Africa] Zimbabwe [Rhodesia], Mozambique; southern parts of Zambia, Malawi and Angola; and South Africa including previous homelands Transkei, Venda, Bhoputhatswana and Ciskei. The particular location of Transkei, its physiogeographic, geomorphic features and Indian ocean have important influence on aspects such as its climate, growth of higher plants as well as lichens. These factors together with altitude effectively contribute to their distribution. The physical selective forces limit the period of acquisition of resources needed for the growth.

Transkei is between 27°-30° E longitude and 30°-33° S latitude, has an area of 44630 Km². The ecologic - geographic variations are from coastal region, hilly midland to mountainous interior with sub tropical climate with hot wet summer and warm dry winter. The "Mozambique current" that carries warm water southwards, greatly influences the temperature of the costal region. The interior is similar to coast but cooler with increasing elevation. The average daily minimum temperature of the coldest month (July) is 7° c and average daily maximum temperature of hottest month (January) is 28° c. Frost does not occur along the sea coast though, within a few kilometres of the sea frost occurs on winter nights. The warmer less dense air of the east coast forms precipitation more rapidly. Average rainfall in summer season is 600 mm. although it varies greatly from place to place. Average rain fall in winter is 200 mm. Towards the end of the winter season, this peninsular region experiences strong gale blowing from south polar region. Relative humidity is approximately 40% in the interior and it varies from 60% - 70% at the coast and midland. The altitude varies from sea level to 2000 m. Habitat ranges from dry mountainous area, grass topped bare hills, humid forests and wild coast supporting varied lichen flora.

The specimens collected from different localities were dried and preserved by customary methods. Repeated visits to the cites were made at different seasons to ascertain the growth form and pattern. Morphology of the upper and lower surfaces of the thalli, rhizine occurrence and the fruiting bodies were examined for the identification of the specimens. Macrophotographs and slides were prepared with a Canon camera using close up lens x 6.



Map of Transkei

Table 1.

Locality	Code	Altitude
Port St. Johns	PSJ	0-100 M
Butterworth	BTH	680 M
St. Patricks	SPT	850 M
Buntingville	BVL	800 M
Hluleka Nature Reserve	HNR	200 M
Umtata	UTA	800 M
Mbotyi	BTI	100 M
Hole-in-the-wall	HWL	100 M
Langeni	LGI	900 M
Engcobo	EGO	1200 M
Libode	LBD	930 M
Matatiele	MTT	1800 M

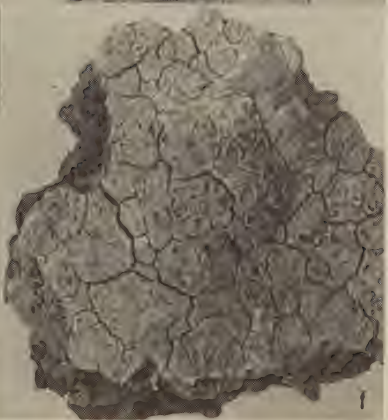
R.B.B. 160. Parmelia(parmotrema) andina Müll. Arg.

Thallus corticolous, foliose lichen, pale greenish to grey. Adnate to the bark, tip of the thallus lobe round. Upper surface smooth and continuous, occasionally marginal part of the thallus is raised and smooth. Isidia and soredia absent. Apothecia are marginal. Lower surface dark brown or central part black with brown or white marginal zone. Very small rhizines are noted at the central part of the thallus or at least on appressed parts. They are black and un-branched. Thalli do not form a coralloid mass as observed in P. (Parmotrema) austerosinensis. Lobes 3-6 mm wide. Occur in the Second Beach at Pt.St. Johns on the bark of mangrove trees near the lagoon and Mbotyi. Rare specimen in the locality. New to southern Africa.

R.B.B. 167. Leptogium cyanescens (Rabenh.) Koerb.

The genus was reported for the first time by P. A. Van der Byll (1931). Thallus corticolous, squamulose, foliose lichen, lobes irregular, loosely attached towards periphery, firmly attached towards the centre. The upper surface of the thallus is black, greyish black, smooth and shiny. Lower surface is also black and smooth. Rhizines do not occur at the tip of the thallus, only at the appressed parts. Apothecia very rare. Occur on sheltered tree trunks and also in open places. The specimens were collected from Hole-in-the-wall and Mbotyi. Species new to southern Africa.

Plate 1- General characters showing different forms of lobes and apices. a- Parmelia andina (Mag. x 2) b- Leptogium cyanescens (Mag. x 2) c- Usnea submolis (Mag. x 2) d- Parmelia (Canomaculina) pilosa (Mag. x 2) e- Heterodermia speciosa (Mag. x 2) f- Diploschistes scruposus (Mag. x 4) Mag. = Magnification.



R.B.B. 169. Usnea submollis Stnr.

Thallus corticolous, fruticose lichen. Pendulous, cylindrical, thallus. Lateral branches of different sizes arise from the main thallus. Pale green to grey. Thallus differentiation similar to node and internode of higher plants are observed. Apothecia occur. There are hair like structures arising from rim of the cup. Soredia absent. Isidia absent. Pseudocyphellae present. This species occur on rather small branches of trees in Langeni and Engcobo. This high altitude, forest species is new record to southern Africa.

R.B.B. 170. Parmelia (Canomaculina) pilosa Stiz.

It is a corticolous, foliose lichen. Olive green. Upper surface smooth. Lower surface black and brownish at the tip. Branched rhizines occur at the thallus lobes. Width of the thallus 5 -8 mm. This species is new report to southern Africa. Collected from the bark of cyprus trees at Libode.

R.B.B. 177. Heterodermia speciosa (Wulf.) Trec.

This genus was reported by Brusse (1992). Thallus lobes adjacent or slightly disjunct. Soredia occur on thallus lobes. Apothecia sessile, laminal. Commonly occurs on shaded part of tree trunks in natural habitat or man made substratum, sometimes on rocks. This species is new to southern Africa. Collected from Buntingville and Libode.

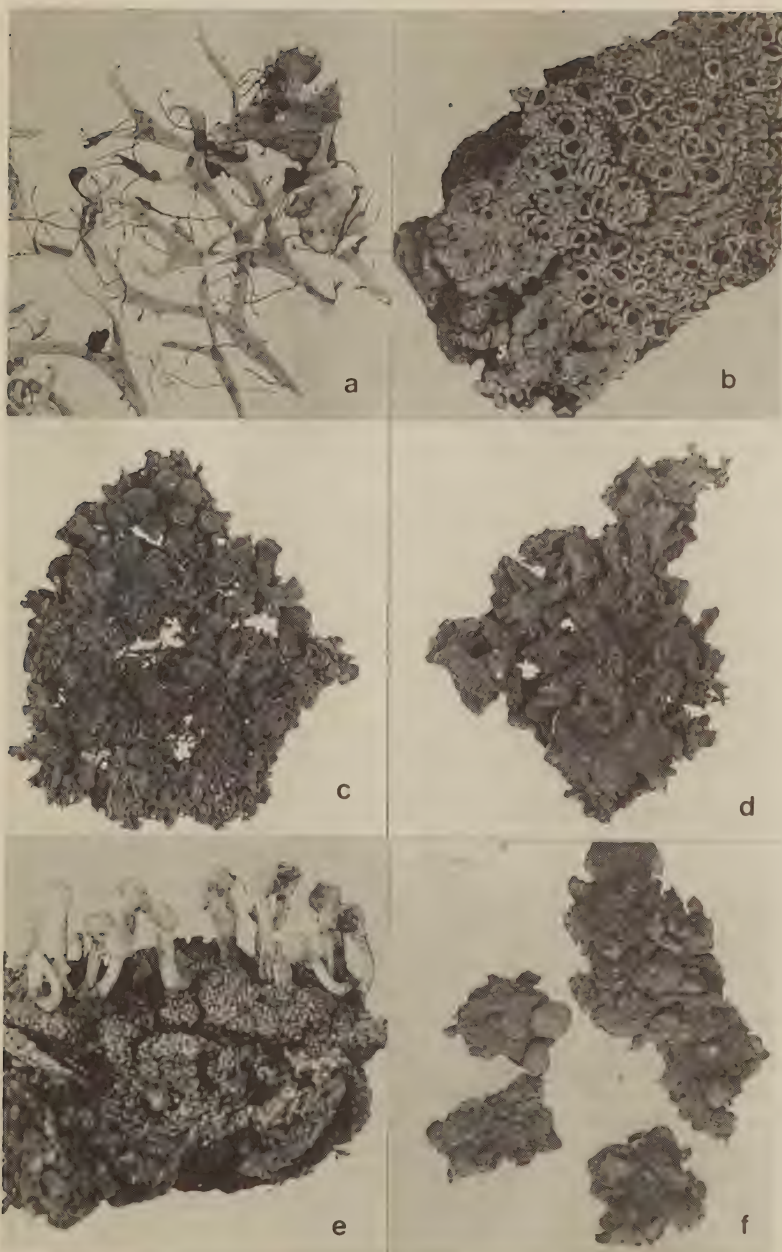
R.B.B. 117. Heterodermia leucomela (L.) Poelt

Thallus corticolous, foliose lichen, forms tuft of hair like structures; irregularly spreading, divided in to linear, ascending or pendulous or erect whitish lobes. Thallus lobes disjunct, dichotomously branched, tapering towards the tip. Upper surface smooth, shiny and flat; green when it is wet and white while it is dry. The lower surface is whitish with round spots. No rhizines. Simple or sometimes branched black hair like structures 2 mm - 8 mm long arise from the margin of the thallus. It is perpendicular to the thallus. Apothecia are not common, laminal on upper surface of the thallus. The thallus grows to a length of 4 cm - 5 cm. and 0.5 mm - 1 mm wide; where the branches originate it is wider 1 mm or more. Most collections are from trees on sheltered parts in cool mountainous region in Mbotyi and Hluleka Nature Reserve. This species is new to southern Africa. The genus is previously reported from coastal Namaqualand (Brusse 1992).

R.B.B. 101. Parmelia (Rimelia) reticulata Tayl.

This has previously been reported by Thomas & Bhat (1994) from Transkei. A new record for southern Africa.

Plate 2- Upper surface of thalli of fruticose and foliose lichens showing vegetative and reproductive features. a- Heterodermia leucomela (Mag. x 2) b- Hyperphyscia syncolla (Mag. x 4) with apothecia (arrow) c- Leptogium phyllocarpum (Mag. x 2) with apothecia (arrow) d- Leptogium coralloideum (Mag. x 2) e- Baeomyces rasens (Mag. x 4) with apothecia (arrow) f- Toninia bumamma (Mag. x 4) with apothecia (arrow).
Mag. = Magnification.



R.B.B. 191. Hyperphyscia syncolla (Nyl.) K. Kalb. Thallus corticolous, foliose lichen, irregular, closely adnate to the substrate, lobes sometimes ascending at the tip; upper surface grey, greyish brown or dark brown. Sometimes margin of the thallus lobes black. Lower surface dark brown or black at the central part; towards the periphery is pale grey or white. Rhizines not observed. Isidia absent. Soredia absent. Dark brown apothecia are common on older part of the thallus. Width of the thallus 2 mm. It occurs on dry decaying bark of exposed trees. It occurs in cool climate at high altitudes. It is a new species for southern Africa. Collected from Buntingville.

R.B.B. 165. Leptogium phyllocarpum (Pers.) Mont.

Thallus terricolous, foliose lichen. Lobes look linear, radiating, black or greyish black. Upper surface with some outgrowths; lower surface plain, no rhizines observed. Very brittle when it is dry and gelatinous when it is wet. Apothecia laminal held on small stalk. Occurs in humid forests at high altitudes. Type specimen was collected from Langeni forest. This is a new species to southern Africa.

R.B.B. 161. Leptogium coralloideum (Meyen & Flot.) Vain.

Thallus terricolous, foliose lichen. Lobes look linear, loosely attached to substratum, upper and lower surface black, no rhizines observed. Brittle when it is dry. Apothecia rare. Width of the thallus 5 mm. Occur in open places at high altitude. A new genus to southern Africa. Collected from Langeni forest.

R.B.B. 153. Baeomyces rasens Pers.

Thallus terricolous, crustose lichen. Flat lobes, sometimes pale green or green. Pink or rose coloured apothecia are held on ascending cylindrical stipes (that gives the appearance of a growing mushroom) which grow to a height of 4 mm - 1 cm. Superficially this species resembles Cladonia by its greenish thallus and ascending apothecial stipes. No rhizines observed. This species has not been reported from any part of southern Africa other than South Africa. The genus is previously reported by Van der Byl (1933). Species new to southern Africa. Locally it is a rare specimen.

R.B.B. 189. Toninia bumamma (Nyl.) Zahlbr.

Thallus terricolous, foliose gives squamulose appearance; dark brown to black. Convex sometimes globose. 0.5 mm diameter. Upper surface pale white. Top part of apothecia is black and surrounded by white covering. Lower side black. Firmly attached to the substratum. Resemble some bryophytes such as mosses. Occurs on rocky mountain slopes about 15 km. from Engcobo towards Elliot. Locally very rare. These rock faces are exposed to continuous cycle of changing weather conditions. Microtopography of such a surface usually allow growth of only specialized crustose lichens. Species new to southern Africa.

R.B.B. 173. Dirinaria picta (Sw.) Clem. & Shear.

Thallus corticolous, foliose lichen. Radiating lobes slender, adnate to the bark of trees. Upper surface of the thallus lobes white, sometimes ash grey tint towards the interior. Lower surface black. Thallus lobes disjunct or adjacent for the whole length. Apothecia not common. The genus and species is new to southern Africa. Occurs in Port St. Johns and Hole-in-the-wall.

R.B.B. 103. Parmelia (Flavoparmelia) soredians Nyl.

Previously reported by Thomas & Bhat (1994) from Transkei. Species new to southern Africa.

R.B.B. 106. Heterodermia diademata (Taul.) Awasthi

The genus has previously been reported by Brusse (1992), Common in natural habitats like tree trunks and man-made substratum such as asbestos, burned brick, fibre glass roof tops etc. Collected from Hluleka Nature Reserve. The species is new to southern Africa.

R.B.B. 118. Ramalina celastri (Spreng.) Krog. & Swinsc.

Previously reported by Thomas & Bhat (1994) from Transkei. Species new to southern Africa.

R.B.B. 181. Diploschistes scruposus (Schreb.) Norm.

Thallus terricolous, crustose, pale green to green. Occurs in shady, moist, places with high humidity. Type specimen was collected from St. Patrick's, near the water reservoir. This genus was previously reported by Brusse (1992). The species is new to southern Africa. Collected from St. Patricks.

R.B.B. 172. Phaeophyscia hirsuta (Meresch.) Mob.

Thallus corticolous, foliose lichen. Thallus lobes flat mostly loosely sometimes firmly attached to the substrate, spread irregularly. Upper side of the thallus is grey to greyish green. Lower side black. Numerous simple, black rhizines present. Apothecia not seen. Occur usually on dry bark on well lit branches of trees and shrubs at high altitudes in cool climate. Width of the thallus 0.5 - 2 mm. New genus to southern Africa. Collected from Buntingville. Locally rare.

CONCLUSION

The literature survey reveals that the eighteen species of lichens collected and investigated are new records to southern Africa. An analysis and evaluation of the dynamics of growth and distribution pattern of most lichens in Transkei region of southern Africa are presented. Most of the genera are locally abundant or wide spread in different distribution zones which indicate that most parts of Transkei remain unexplored from lichenological point of view. Parmelia andina is reported exclusively from east coast of South Africa. Usnea submolis occurs in high altitude areas only. Taxa of the Collemaaceae and Pyxinaceae show a strong preference to interior, is influenced by high altitude. Ramalinaceae also shows a similar distribution pattern. Some types of lichens establish themselves in substratum unsuitable for any form of plant growth, can be considered as pioneers in the ecological succession (Garty, 1990). The Cladoniaceae are restricted to higher altitudes where humidity is high. The Teloschistaceae seems to be restricted to middle-land where savannah and shrubs dominate. Baeomyces occurs only in the cool high-land zone of Transkei in Langeni pine forest. Occur on bare exposed earth by road bank and tracks where erosion of soil has taken place. Grows over acid soil or mineral soil. The water reservoir and the road provide a break in the canopy and shade provided by the forest trees. The conditions

on bare exposed ground is suitable for this terricolous lichen. It can be considered as a colonizer of freshly exposed bare earth by tracks and roads. But *Toninia* are high altitude lichens capable of colonizing bare exposed substratum. Grow in very extreme microclimatic conditions on thin residual soil that occur in crevices of volcanic rock that was liable to be eroded by wind or rain. It can be considered as a colonizer of exposed rock.

The ecological factors which influence the growth of lichens appear to be the availability of light, moisture and characteristics of the host tree or substratum (Kantvilas, 1985, 1988). In South Africa, Transkei in particular climatic variability is high and frequent. It seems that the frequency of variations of extreme elements of climate, sequence and the timing of these events together with geomorphic features are important factors for the poor distribution and growth forms of lichens in this country; rather than nature of the substratum, wild fires, competition among lichens and bryophytes, environmental pollution or by man's influence in nature, trampling and predation by animals as observed in the polar regions. Some resistance and adaptation in lichens can be expected from previous exposure to stress of the same kind as observed in higher plants.

Baeomyces and *Toninia* can be considered as colonizers of a bare substratum. As time passes, changes in the amount of shade provided by nearby trees, the decaying leaves, moisture, marked changes in intensity of heat and light related to change of seasons such as dry winter to wet summer in Eastern Cape and wet winter to dry summer in Western Cape etc. changes the nature of the substrate and microclimatic conditions. This leads to the occurrence of other species with more elaborate thalli. Older ones are replaced by new ones. This results in succession among communities. Lichens with crustose thalli give way to foliose types and later to mosses. The inability of lichens to compete successfully with bryophytes is contributed by symbiotic nature of lichens is an additional factor in favouring succession of lichen communities.

ACKNOWLEDGEMENTS

Our thanks are also due to Prof. Darrell J. Weber, Department of Botany and Range Science, Brigham Young University, Provo, Utah, U.S.A. for valuable suggestions and critical review of the manuscript. We are also grateful to the Department of Forestry, Transkei, South Africa for the necessary permit to collect the lichens from the forests and nature reserves. R.B. Bhat acknowledges the University of Transkei, Umtata, South Africa, for the financial assistance.

REFERENCES

- Brusse, F.A. 1992. A new species in the lichen genus *Heterodermia* from coastal Namaqualand. *Bothalia* 22(2): 183-184.
- Doidge Ethal, M. 1950. The South African fungi and lichens to the end of 1945. *Bothalia* 5: 1-1094.

- Garty, J. & Binyamini, N. 1990. Establishment of pioneer litho-microorganisms on chalk rocks after a severe forest fire in Israel. *Environmental and Experimental Botany* 30(2): 127-139.
- Kantvilas, G. 1985. Macrolichens in Tasmanian rain forests. *Lichenologist* 17: 67-83.
- Kantvilas, G. 1985. Studies on Tasmanian rain forests lichens. Ph.D. thesis, University of Tasmania.
- Kantvilas, G. 1988. Tasmanian rain forest lichen communities: a preliminary classification. *Phytocoenologia* 16(3): 391-428.
- Thomas, C.M. & Bhat, R.B. 1994. Contribution to the lichen flora of Transkei. *Mycotaxon* 50: 9-18.
- Thomas, C.M. & Bhat, R.B. 1995. Some advances in the lichenological exploration of southern Africa since the time of Linnaeus I. *Biologia* 50(1): 1-8.
- Van der Byl, P.A. 1931. *Annales of University of Stellenbosch*. Series IX(A3): 1-17.
- Van der Byl, P.A. 1933. *Annales of University of Stellenbosch*. Series XI(A4): 1-13.

Studies in North American *Cortinarii* II. Interesting and new species collected in the North Cascade Mountains, Washington.¹

M. M. MOSER

Institute of Microbiology
University of Innsbruck
Technikerstr.25
A-6020 Innsbruck

and

J. F. AMMIRATI

Department of Botany, KB-15
University of Washington
Seattle, Washington 98195 USA

Abstract. Twelve taxa of *Cortinarius* are recorded in this paper from the North Cascade Mountains, Washington, ten of them are described in detail. *Cortinarius ionema* Mos. & Ammirati is described as new species, *C. albobrunnoides* var. *violaceovelatus* as a new variety. Three European species are recorded for the first time from North America. The taxonomic position of *C. griseoviolaceus* A.H. Smith is discussed. Synonymies between *C. umidicola* Kauffm. and *C. canabarba* Mos., *C. impolitus* Kauffm. and *C. incisus* ss. Fr., Mos. (non Pers.), and between *C. badiovinaceus* Mos. and *C. nigrellus* Peck var. *occidentalis* A.H. Smith are presented.

Key words: *Cortinarius*, *Phlegmacium*, *Sericeocybe*, *Telamonia*, Washington

This paper is the second of several dealing with species of *Cortinarius* in western North America. The present one treats species from the North Cascades in the state of Washington while the first and third (Moser 1993, Moser et al. 1995) are on species from the Greater Yellowstone area.

¹Part I Mycotaxon 55:301-351, part III Sydowia 45(2):275-306

Main collecting sites for the present report include, 1) Barlow Pass, Mountain Loop Road, Snohomish County, elevation 700 m, 2) Stevens Pass, Highway 2, King County, elevation ca 1250 m, 3) Easy Pass Trailhead, Skagit County, near Highway 20, elevation 1140 m, 4) Rainy Pass, Chelan County, on Highway 20, elevation 1470 m, and 5) Lake Ann, Chelan County, southwest of Rainy Pass, elevation 1660 m. The sites range in latitude from 47°45'N to 48°30'N. All sites represent late succession forests in the North Cascades physiographic and geologic province. The Barlow Pass site is forested by *Abies amabilis* (Dougl.) Forbes (Silver Fir) and *Tsuga heterophylla* (Raf.) Sarg. (Western Hemlock) and is in a cold air drainage along the Sauk River. Stevens Pass is a subalpine conifer forest of *A. amabilis*, *A. lasiocarpa* (Hook.) Nutt. (Subalpine Fir), *Tsuga mertensiana* (Bong.) Carr (Mountain Hemlock) and *Chamaecyparis nootkatensis* (D. Don) Spach (Alaskan Yellow Cedar) with *T. heterophylla* and *Pseudotsuga menziesii* (Mirbel) Franco (Douglas Fir) in certain places. *Alnus sinuata* (Regel) Rydb. (Sitka Alder) occurs on steep slopes and along small streams. The Easy Pass Trailhead area is composed of a mixture of conifers, including *A. lasiocarpa* and *T. mertensiana*, *T. heterophylla*, *P. menziesii*, *Picea engelmannii* Parry (Engelman Spruce) and *Pinus monticola* Dougl. (Western White Pine). In moister areas along Granite Creek *A. sinuata* and *C. nootkatensis* also occur. At Rainy Pass *A. amabilis* and *A. lasiocarpa* occur with *T. mertensiana* as well as some *P. engelmannii* and scattered *P. menziesii*. At Lake Ann, a truly subalpine forest occurs, dominated by *A. lasiocarpa* and *T. mertensiana* with *Larix lyallii* (Perl.) (Tamarack) in some areas. Shrubby *Salix* species occur at the lower end of the lake and along the outlet stream. For the vegetation of some Wyoming localities mentioned in this paper see Moser et al. (1994).

Methods

For Methods see part 1 and part 3 of the series. Descriptions of microscopic characters were taken from sections mounted in 3% KOH and spore measurements are whenever possible from spore prints, otherwise from cortina or lamellae. Inidation of lamella density: L = total number of lamellae reaching the stipe and l = number of lamellulae between two lamellae. Comparison of the lamella width with the thickness of the pileus context was made about half the radius of the pileus. Abbreviations in spore measurements: S = standard deviation ($n = 31$), Q = quotient of spore length through spore width, V = approximate volume. Color guides include Munsel Soil Color Charts (example of notation, Mu 2.5YR2/4) and R. Ridgway, Color Standards and Color nomenclature (example, Carob Brown (R)), A. Cailleux, Code des Couleurs des Sols (Example, Caill 55S). Macrochemical color reactions were made with 3% or 30% KOH and/or saturated NH_4OH . Collections of M. Moser are deposited at the Institut für Botanik der Universität Innsbruck (IB) and those of J. Ammirati (JFA) at the University of Washington Herbarium (WTU). Where IB and JFA collections are cited under the same date and from the same locality this are split collections.

Data & Discussion

Subgenus *Phlegmacium* (Fr.:Fr.) Trog.

Cortinarius (*Phlegmacium*) *blattoi* Mazza (1992) (?)
(Fig. 1, 20)

Syn.: *C. pseudobalteatus* Blatto nom. subnud. (1982) (?)

Missidentification: *C. corruscans* ss. Cetto (1987)

P i l e u s 4-13 cm across, convex, margin involute at first, later obtusely convex, finally becoming plano-convex, sometimes subumbonate, sometimes depressed with age, margin slightly rugulose to wrinkled (for about 1-2 cm) in age, glutinous, then sticky and shiny when dry, color gray brown, Fawn Color (R) to Army Brown (R), sometimes also more vinaceous brown, Cameo Brown (R) or slightly Mikado Brown (R) toward the center, the margin often more yellow-brown to brown, central area sometimes with a pale bloom, usually with very fine rivulose pattern, marbled to pruinose by the covering of the veil, somewhat streaked toward the outer margin, the young margin may be strongly covered, veil violaceous but appearing white in expanded pilei.

L a m e l l a e at first near whitish, pale argillaceous (Caill 71L) but some areas can be distinctly lilac, later pale brown, about Cinnamon Buff (R), only slightly darker in age, edge strongly eroded, concolor or paler and sometimes lilac tinted, adnexed to emarginate or broadly and shallowly sinuate, crowded, L about 160, l=1-3, 20-22/cm at the margin, 6-8 mm broad (equaling the thickness of pileus context).

S t i p e 6-8.3 cm long, 14-32 mm thick, base 16-37 mm, equal to clavate, sometimes tapered below, firm and solid, surface whitish, Light Buff (R) to lilac in young specimens, cortina whitish, universal veil leaving large violaceous (Lavender Gray (R), Plumbago Blue (R)) patches and partial belts on the lower half of the stipe.

C o n t e x t solid, firm to softer in age, in pileus 14-20 mm thick under the disc, gradually thinner toward the edge, white or whitish to Light Buff (R) in pileus and stipe, yellowish to dull ochraceous buff or orange buff in larval tunnels. Odor sweetish, not very strong. Taste mild.

C h e m i c a l c h a r a c t e r s: KOH yellow-brownish spots with yellowish margin in the context, NH_4OH slightly yellowish brown.

M i c r o s c o p i c c h a r a c t e r s: Spores 8.7-12 x 5-6 μm , mean 10.1 ($S = 0.75$) x 5.4 ($S = 0.22$), $Q = 1.9$, volume 113-190, mean 155 ($S = 14.7$). Basidia 30-32 x 7.5-8.5 μm , 4-spored, edge of lamellae with basidia and basidioles. Pileus surface with gelatinous layer of repent, hyaline hyphae of 4-6 μm , with clamp connections and heavy, hyaline encrustation, epicutis of hyphae of 6-12 μm , walls brown, encrusted, hypodermium with inflated cells which are also brownish encrusted, hyphae of the trama hyaline.

H a b i t a t: Under *Abies lasiocarpa* in subalpine forest.

Collections examined :IB 91/353 and JFA 9993, collected by J. Ammirati, M. Moser, D. Louma and J. Trappe near Lake Ann above Rainy Pass, Chelan Co., Washington, 29-08-1989, IB 91/392, same area, but 03-09-1989, leg. M. Moser & J. Ammirati

C o m m e n t s: We are convinced that our record is identical with *Cortinarius blattoi* Mazza, recently described from subalpine forests in northern Italy. However, we must have some reservations because we were unable to obtain the type collection for comparison, in spite of several attempts. *Cortinarius blattoi* is closely related to *C. praestans* Cord. and has several characters in common with it, including the coloration of pileus and veil, the often wrinkled pileus surface and the compact context. *C. blattoi* has smaller basidiomata and much smaller spores than *C. praestans*. It has on the other side the typical KOH reaction in common with the group of *C. balteatus*. *Cortinarius durissimus* (Mos.) Mos. is an other European species in this

group with similar, but narrower spores, more vinaceous to violaceous brown pileus colors and an ochraceous universal veil. *Cortinarius nebularis* Hry. ex Hry. also might be eventually found to belong to this group but it has a more dingy whitish to grayish pileus color (similar to *Clitocybe nebularis* or *Hygrophorus agathosmus*), the pileus surface is not wrinkled and it is associated with broadleaf trees. The chemical reactions with ammonia and potassium hydroxide seem to be similar but more pronounced and vivid in *C. nebularis*. Cetto (1987, vol.5, pl. 1781) figures the fungus under the erroneous name *Cortinarius corruscans*. Blatto (1988) figures and describes a similar fungus under the name *Cortinarius pseudobalteatus* Blatto. The plate of Blatto is less convincing. Moreover the name *C. pseudobalteatus* is not validly published.

Cortinarius (Phlegmacium) albobrunnoides Mos. & McKnight

This species has been recorded several times from Wyoming and a detailed description is published in part I of this series (Moser, McKnight and Ammirati 1995). In Washington we observed the type variety and also a variety with a violet universal veil. This variety is described below.

Cortinarius (Phlegmacium) albobrunnoides Mos. & McKnight var. *albobrunnoides*

Collection examined: IB 89/479, Rainy Pass, near trailhead to Lake Ann, Chelan Co., Washington, under *Picea engelmannii* and *Abies lasiocarpa*, 12-09-89.

Cortinarius albobrunnoides Mos. & McKnight var. *violaceovelatus* Mos. & Ammirati var. nov.

(Fig.2, 23)

Differt a typo velo violaceo et stipite coloribus violaceis. Holotypus IB 89/478, sub *Abieti lasiocarpa*, *Picea*, *Pseudotsuga*, ad iugum "Rainy" dictum, Chelan Co., in montibus Cascadensibus septentrionalis, Washington, 12-09-1989, leg. M. Moser & J. Ammirati

P i l e u s 3.5-7 cm across, convex to obtusely convex, plano-convex or slightly umbonate, margin involute at first, later decurved, at times somewhat undulate, glutinous, sticky under dry conditions, in age only finely and innately streaked to rivulose, red-brown, Caill 37S, Kaiser Brown (R) to Carob Brown (R), disc darker, with orange tinge or almost purplish brown, paler toward the margin, in a few places Cream Buff (R), otherwise Caill 40P to 40N or 45M, Orange Ochraceous Buff (R) or with Apricot Buff (R) to reddish orange colors, the very margin sometimes paler due to the covering by the veil, sometimes spotted.

L a m e l l a e argillaceous at first (Caill 70M), then pale to light dull brown, gray-brown, near brownish yellow (Mu 10YR6/6), darker brown with age, edges slightly eroded, slightly to distinctly emarginate, close to crowded, L = about 100, l = 1-3, 10/cm at the margin, up to 7 mm wide.

S t i p e 3-5.2 cm long, apex 9-18 mm, the marginate bulb up to 25 mm thick, bulb oblique to more or less depressed above the rim, surface at apex silky fibrillose, pale violaceous, soon fading to whitish with age, but otherwise the stipe retaining some violaceous color for some time, the young bulb fringed by violet veil,

sometimes almost volva-like, the margin of veil fringe becoming more whitish. Mycelium on underside of the bulb yellow, Sulphur Yellow (R).

C o n t e x t 8-10 mm on the disc, solid, firm, white violaceous in the stipe cortex to the rim of the bulb, otherwise whitish in the stipe. Without distinctive odor or slightly of green apples. Taste mild.

C h e m i c a l r e a c t i o n s: KOH brown on the pileus cuticle, negative in the pileus context.

M i c r o s c o p i c c h a r a c t e r s: Spores 10.7-13.3 x 6-7.3 μ m, mean 12 (S = 0.61) x 6.6 (S = 0.31), Q = 1.8 (S = 0.3), volume 270 (S = 32.3), sublimoniform to lemon-shaped, verrucose. Other characters as in type variety.

H a b i t a t: Under *Pseudotsuga menziesii* and *Abies lasiocarpa*.

Collections examined: IB 89/478 (holotype), and JFA 10070 (isotype), Rainy Pass, trailhead to Lake Ann, Chelan Co., Washington, 12-09-1989

Cortinarius (Phlegmacium) aureofulvus Mos. (1952)

For full description of this species see part I of the series (Moser, McKnight and Ammirati 1995).

Collections examined: IB 89/428 and 89/474, both at trailhead to Easy Pass, Skagit Co., Washington, under *Picea engelmannii* and *Abies lasiocarpa*, 06-09 and 12-09-1989.

Cortinarius (Phlegmacium) guttatus R. Henry (1951)
(Fig.3)

P i l e u s 4-9 cm across, broadly hemispheric to convex or broadly convex, margin involute at first and remaining so for an extended period, disc broadly umbonate to somewhat flattened, glutinous, sticky when dry, olive yellowish green, Caill 80M to 80N, 90N, margin at first Pale Yellow Green (R), Light Dull Green-Yellow (R), disc at first Dark Olive Drab (R) to Light Yellowish Olive (R), usually with Olive Brown (R) to Natal Brown (R) tones, with larger or smaller olive brown or even reddish brown areas, Caill 69S, 49R, 67R, Natal Brown (R), and often guttate and spotted by dried gluten, margin faintly streaked, disc sometimes Deep Colonial Buff (R) mixed with brown and olive tinges with age.

L a m e l l a e yellow at first, Chalcedony Yellow (R), later becoming more olive-yellow to olive brownish, Colonial Buff (R), Caill 80N, 87K, edges eroded, emarginate to broadly emarginate, crowded, L about 100, l = 3, 20/cm at the margin, up to 8 mm broad (equals thickness of pileus context).

S t i p e 4-8.5 cm long, 11-18 mm in upper part, up to 40 mm at the obliquely marginate bulb, pale yellow, Caill 85K, Sulphur Yellow (R), Naphthalen Yellow (R), Barium Yellow (R), base and apex often slightly darker, shiny, somewhat longitudinally fibrillose, the bulb fringed by lemon yellow veil, Citron Yellow (R) to Wax Yellow (R), bulb white underneath. Cortina pale yellowish to whitish.

C o n t e x t 8-15 mm thick at the disc, gradually, then more abruptly thinner toward the edge, solid, firm, pale dingy yellowish at first in the pileus and bulb (like slightly oxidized apple slices), brighter yellow greenish in the stipe, in the interior sometimes whitish. **O d o r** slightly but distinctly spicy (close to odor of majoram) (same odor as in *C. percomis* but much weaker). Taste mild.

C h e m i c a l r e a c t i o n s: KOH brown on the pileus cuticle, olive

brownish on the context, dull reddish on the surface of the stipe base with veil, in the interior gray-brown. NH_4OH slightly brownish on the context.

Microscopic characters: Spores $10.7\text{--}13.3\text{--}(13.8) \times 6\text{--}7.7 \mu\text{m}$, mean 12 ($S = 0.81$) $\times 6.9$ ($S = 0.39$) μm , $Q=1.7$, volume $201\text{--}389$, mean 306 ($S = 49.9$) sublimoniform to limoniform, verrucose. Basidia $32\text{--}36 \times 9.5\text{--}10 \mu\text{m}$, 4-spored, clavate, with basal clamp connection, sterigmata $3\text{--}3.5 \mu\text{m}$. Cheilo- and pleurocystidia absent. Gelatinous pellicle on pileus surface of hyphae $3.5\text{--}4.5 \mu\text{m}$ wide with clamp connections, which are irregularly ascending in upper layer and more or less repent close to the epicutis, hyphae of epicutis radially arranged, $5.5\text{--}7\text{--}(10) \mu\text{m}$ wide, walls yellowish (greenish) or brownish in places, some hyphae also with brownish content, tramal hyphae $9\text{--}18 \mu\text{m}$ wide, in deeper layer up to $25 \mu\text{m}$, becoming pseudo-parenchymatic. Hyphae of the cortina $3\text{--}4 \mu\text{m}$ thick with clamp connections.

Habitat: under *Picea engelmannii*, *Abies lasiocarpa* and *Pseudotsuga menziesii*.

Collections examined: **Washington:** IB 89/424, JFA 10036 Trailhead to Easy Pass, Skagit Co., Washington, 06-09-1989; IB 89/463 and 89/463a and JFA 10066 from same area, 12-09-1989, leg. J. Ammirati, M. Moser. - **Wyoming:** IB 89/208, JFA 9911, Fourmile Meadow, Teton National Forest, 11-08-1989, IB 89/230, JFA 9942, same area 14-08-1989, IB 89/230a, JFA 9943, same area and date, IB 89/299, Fourmile Meadow but seepage area south of Highway, leg. K. McKnight.

Comments: *Cortinarius guttatus* is related to *C. percomis*, but differs in duller, more olivaceous colors, in the marginate bulb, and in chemical reactions. It has a similar but much weaker spicy odor. The above described material agrees well with European material. Brandrud et al. (1992) synonymize *C. guttatus* ss. Moser (Gatt. Phlegm. p.310) with *C. sulfurinus* Quel. This is certainly incorrect. *C. guttatus* differs in several major characters from *C. sulfurinus* (Quélet 1884). It does not have the white-citrin colored stipe, the sulphur yellow pileus with white margin, the context which is white at first, the white cortina, and differs also in the spicy odor.

Subgenus *Sericeocybe* P.D.Orton

Cortinarius (Sericeocybe) griseoviolaceus A.H.Smith (1944)
(Fig.5, 6)

Pileus $2.5\text{--}9$ cm across, hemispherical, then convex, not hygrophanous, glutinous when moist, only slightly sticky and silky when dry, pale grayish violaceous, near Pale Kings Blue (R) or Sky Gray (R), sometimes almost white, later mixed with slight ochraceous tinges over the disc, changing to dark violaceous gray (Deep Quaker Drab (R)) where touched.

Lamellae gray when young, Ecu Drab (R), soon dark gray brown, near Saccardos Umber (R) or even Benzo Brown (R) and Drab (R), later closer to milk coffee brown, Drab (R) with a tinge of more brown, edges eroded, adnate, close to crowded, L about 60, $l = 3\text{--}7$, $20/\text{cm}$ at the margin, $5\text{--}9$ mm broad (= twice the thickness of the pileus context).

Stipe $5\text{--}7$ cm long, apex $10\text{--}20$ mm thick, base up to 25 mm thick, clavate, concolorous with the pileus, peronate by a white veil but the surface remaining distinctly glutinous when wet. The veil white and silky.

Context pale grayish brown, watery grayish when moist. No reaction with KOH.

Microscopic characters: Spores $7.3-9.3 \times 4.7-5.3 \mu\text{m}$, mean 8.3 ($S = 0.49$) $\times 5$ ($S = 0.23$), $Q = 1.6$, volume $82-139$, mean 106.5 ($S = 12.9$). Smith (1944) gives spore measurements of $7-9(10) \times 5-6 \mu\text{m}$, in our measurements of spores of the holotype (A.H. Smith HT 17228) we found the following values: Spores $8.0-10.3 \times 5.2-6 \mu\text{m}$, mean 8.7 ($S = 0.47$) $\times 5.6$ ($S = 0.24$), $Q = 1.6$, Vol. = $117-182$, mean = 142 ($S = 17.3$). Lamellae edges with basidia and basidioles, basidia $32-36 \times 8-9 \mu\text{m}$, 4-spored, clavate. Gelatinous layer on the pileus composed of hyphae $3-4(-5) \mu\text{m}$ wide, clamp connections present, with gelatinous interhyphal spaces. Epicuticular hyphae $9-14 \mu\text{m}$ wide. Epicutis often rather thin, hypodermium cellular, elements $40-60 \times 20-30 \mu\text{m}$. Pileus trama regular to pseudoparenchymatic in lower portion. Gelatinous covering on stipe much thinner, consisting of hyaline hyphae $3.5-4.5(-5) \mu\text{m}$ wide, with clamp connections.

Habitat: Under *Picea engelmannii*, *Abies lasiocarpa*.

Collections examined: IB 89/409, trailhead to Easy Pass, Skagit Co., Washington, 03-09-1989; IB 89/472, same area, 12-09-1989; A.H. Smith 17228 (holotype), Mt. Angeles, Olympics, Washington, 24-09-41.

Comparison of the microscopic data with European material of *Cortinarius albobviolaceus* Fr. coll. 89/496 (Fig.4)

Spores $8-10.3 \times 5.3-6.2 \mu\text{m}$, mean 9 ($S = 0.45$) $\times 5.5$ ($S = 0.22$) μm , ellipsoid, verrucose. Basidia $32-35 \times 8-8.5 \mu\text{m}$, clavate, 4-spored, with clamp connection. Epicutis of radially arranged, hyaline hyphae of $4-7(-8) \mu\text{m}$ wide, with clamp connections, hypodermium with broad hyphae to subcellular, segments $30-50 \times 15-17 \mu\text{m}$. Hyphae of the cortina $3-4.5(-5) \mu\text{m}$ wide, with clamp connections.

Comments: Smith (1944) placed this taxon in Subgenus *Myxadium*, in agreement with the general definition of the subgenus: glutinous surface of pileus and stipe. However, he also stressed the similarity of *C. griseoviolaceus* and *C. albobviolaceus* Fr. Brandrud et al.(1989) regard *C. griseoviolaceus* as a synonym of *C. emunctus* Fr.(= *C. griseolilacinus* Britz.). This synonymy is certainly incorrect. They may have been misled by the black-and-white photograph published by Smith (1944) which shows some abnormally slender and long-stipitate fruitbodies. *C. griseoviolaceus*, however, has no similarity with *C. emunctus*, neither in macroscopic nor microscopic characters. Its relationship lies with *Sericeocybe* and it very closely resembles *C. albobviolaceus* when dry. Gelatinization of the surface layers of pileus and stipe are characters widely used by cortinariologists to separate subgenera. Certainly this is a rather convenient means for classification. As a result of having studied *Cortinarii* from several continents, however, we have come to the conclusion, that these characters have independently evolved several times in *Cortinarius*. We know a group of typical *Telamonias* from the Southern Hemisphere which have a distinct gelatinous pileus surface (Moser & Horak 1975) and some species of subgenus *Icterinula* have the same characteristic. In *Sericeocybe* we know several taxa even from Europe, which show at least some tendency for gelatinization of the pileus surface. So we are inclined to regard *C. griseoviolaceus* as a taxon closely related to *C. albobviolaceus* but with a gelatinized surface layer on pileus and stipe.

Cortinarius (Sericeocybe) ionema Moser & Ammirati spec. nov.
(Fig.7, 21, 27)

Etymology: *ionema* from greek *iov* = violet, *nema* = fibrill, thread

Pileo 2-7.2 cm lato, primo hemisphaerico dein convexo demum applanato, interdum leviter umbonato, nec hygrophanus, siccus, glabro, sed plerumque oblecto e fibrillis albidis, in aetate saepe lacerato-subsquamuloso pallide brunneo, e velo lilaceo saepe oblecto et saepe appendiculato, lamellis pallide brunneis, emarginatis, subdistantibus, acie concolori, stipite 7-8.6 cm longo, 8-18 mm, basi 12-30 mm crasso, plus minusve clavato, lilaceo, brunnescente in parte inferiore sed oblecto cingulatove e velo lilaceo, carne pilei albida, in parte superiore stipitis lilacea, in parte inferiore albida vel brunneola, KOH ope carne reactionem griseo-brunneam, in cuticulam brunneam praebente. Odore dulcidulo, sapore miti.

Sporis 8-10 x 4.7-5.8 μm , ellipticis, verrucosis, basidiis 36-40 x 8-10 μm , tetrasporigeris, clavatis, cheilocystidiis inconspicuis, fibulis praesentibus.

Habitatio: prope *Salix* sp. in vicinitate *Abieti lasiocarpae*, holotypus IB 80/389, isotypus JFA 10070, prope lacum dictum "Ann" supra iugum "Rainy", Washington, 03-09-1989, leg. M.Moser et J. Ammirati.

P i l e u s 2-7.2 cm in diameter, hemispherical before expanding, then convex or more obtuse at first, margin incurved, becoming plane in age, often with a low umbo, not hygrophanous, dry, glabrous at first, but often covered by white appressed fibrils, later sometimes somewhat cracking and tending to become lacerate and forming small squamules, but not over the entire surface, color pale ochraceous brown, Light Pinkish Cinnamon (R), Cinnamon Buff (R), Pale Pinkish Buff (R), later more grayish brown, particularly toward the disc, but sometimes with some brownish areas, Cinnamon (R) or Mikado Brown (R), the margin covered by a rather strongly developed violaceous universal veil, Deep Plumbago Blue (R), Deep Grayish Lavender (R).

L a m e l l a e grayish brown from the beginning, Cinnamon Buff, Clay Color, Tawny Olive to Sayal Brown (R), edges moderately to strongly eroded, adnate to slightly emarginate, close to subdistant, L= about 60-70, l=1-(3), 12/cm at the margin, (3)-4-8 mm broad (=twice the thickness of the pileus context).

S t i p e 6-8.6 cm long, apex 8-18 mm, base 12-30 mm thick, occasionally the base somewhat fusoid, light to pale lilac, Grayish Lavender (R), Pale Grayish Violet-Blue (R), Pale Campanula Blue (R), Plumbago Blue (R), covered by the violet veil, Deep Vinaceous Lavender (R), which may form floccose squamules or an appressed belt and patches, lower surface becoming pale brownish to watery brownish, darker watery brownish with age. Basal mycelium whitish.

C o n t e x t 7-9 mm thick on the disc, gradually thinner toward the edge, solid, firm, dingy whitish in young pilei, slightly violaceous in the apex of the stipe, pale grayish brown in the base, later grayish brown when moist, pallid, Light Buff (R) when dry in the pileus and parts of the stipe. **O d o r** fragrant sweetish, similar but not as strong as in *C. calopus* Karst.(= *C. fragrans* Smith), taste mild.

C h e m i c a l r e a c t i o n s: KOH almost negative, slightly gray-brown on the pileus surface, grayish brown or no reaction on the context.

M i c r o s c o p i c c h a r a c t e r s: Spores 8.2-10.6 x 4.7-6.5 μm , mean 9.3 (S = 0.59) x 5.4 (S = 0.34), Q = 1.7, volume 99-232, mean = 145 (S = 25.4), elliptical

verrucose. Basidia 36-40 x 7.5-8 μm , 4-spored, clavate, with basal clamp connection, sterigmata 2-3 μm long, lamellae edges with scattered, inconspicuous cheilocystidia similar in size to the clavate to subcapitate. Epicuticular hyphae 5-8 μm wide, radially arranged, walls pale yellowish in KOH, with clamp connections. Hypodermal hyphae 12-18 μm wide, radially arranged, more or less hyaline, with clamp connections, tramal hyphae similar but hyphae in deeper layers are somewhat irregular. Veil from lower part of the stipe with hyphae 4-5 μm wide, with clamp connections, hyphae of stipe cortex 5-9 μm , more or less parallel.

H a b i t a t: Under *Salix* sp. but *Abies lasiocarpa* a few meters away.

Collections examined: **Washington:** IB 89/389, (holotype), JFA 10015 (isotype) Lake Ann, above Rainy Pass, Chelan Co., Washington, leg. M. Moser & J. Ammirati, 3 Sept. 1989; IB 89/344, same locality, 29 Aug. 1989, (immature specimens). **Wyoming :** IB 83/221, Elk Creek, Yellowstone National Park, under *Picea engelmannii*, 8 Aug 1983, IB 91/420, Falls River above waterfall Yellowstone National Park, *Picea engelmannii*, *Abies lasiocarpa* 4 Sept. 1991

C o m m e n t s: The species is a typical *Sericeocybe* and can eventually be confused with *C. calopus* P.Karst. Both species have a similar odor and similar colors, but the pileus color in *C. calopus* is more reddish brown, the veil in young specimens more wooly (fluffy) and usually the stipe is more slender and longer. The spores are rather similar, in the holotype of *C. fragrans* A. H. Smith, coll. 17713 we found the spores 8-10.7 x 4.7-6 μm , mean 9.4 x 5.5 μm , Q=1.7, volume (mean) 151, elliptical but only punctate, appearing nearly smooth under light microscope.

Subgenus *Telamonia* (Fr.:Fr.)Trog

Cortinarius (Telamonia) alnetorum (Vel.1921) Mos.
(Fig.8)

Misidentification: *C. glandicolor* Fr. var. *curtus* Fr. ss. A.H.Smith p.p. (1944)

P i l e u s 1-2.6 cm in diameter, obtusely conic to convex or applanate, often with an umbo, sometimes depressed in the center around the umbo, margin decurved to nearly plane, hygrophanous, somewhat translucently striate when moist, sometimes margin becoming slightly wrinkled as it fades, dark brown (Caill 50S), center often almost blackish (Caill 50T), covered by white veil fibrils particularly near the margin but sometimes also over the entire surface, drying centripetally, becoming grayish brown (Caill 49P or even paler), Cinnamon Brown (R) to Snuff Brown (R) with darker, blackish brown streaks, eventually lighter brown (near Caill 49M) but center remaining dark.

L a m e l l a e grayish brown, Sayal Brown (R), sinuate to emarginate, edges slightly eroded and sometimes slightly paler than the faces, subdistant, L about 20, l= 1-3, 12-14/cm at the margin, slightly ventricose, 2-3 mm broad (= 4-5 times the thickness of the pileus context).

S t i p e 4-7 cm long, 2-4 mm thick, more or less equal, pale umber brownish, Wood Brown (R) to Avellaneous (R), silky whitish at the apex, below the cortina covered by grayish white, abundant veil which forms belts and patches. Narrowly hollow when mature.

C o n t e x t very thin throughout the pileus, to 1.5 mm under the disc, umber brown when moist, in dry condition pale gray-brown, in the stipe light brown. O d o r fungacious or of freshly cut grass or herbs (potato leaves). Taste slightly raphanoid or of cucumber rind.

C h e m i c a l r e a c t i o n: KOH blackish brown to black on the pileus surface and context.

M i c r o s c o p i c c h a r a c t e r s: Spores $9.2\text{--}12.3 \times 4.8\text{--}6.7 \mu\text{m}$, mean 10.2 ($S = 0.71$) $\times$ 5.6 ($S = 0.35$), $Q = 1.8$, volume 110-259, mean = 170 ($S = 29$), elliptical elongate, verrucose, basidia $33\text{--}36 \times 9.5\text{--}10 \mu\text{m}$, 4-spored, with basal clamp connection. Cystidia absent. Hyphae of lamellar trama $7\text{--}15 \mu\text{m}$ wide, narrower in the subhymenium.

H a b i t a t: Under *Alnus sinuata* (Regel) Rydb. on sandy soil and among mosses along a stream.

Collection examined IB 89/377, JFA 10010, Stevens Pass, below freeway where the old highway leaves the freeway, King Co. (at border with Chelan Co.), Washington, 01-09-1989, leg. M. Moser; Joyce, Washington, 29-09-1941 leg. A. H. Smith (17383)

C o m m e n t s: This fungus was recorded by A. H. Smith from Joyce, Washington under alder, 29 Sept 1941 (coll. Smith 17393) under the name *C. glandicolor* Fr. var. *curtus* Fr. Other records from North America are not known, but it certainly is more widely distributed and should occur under *Alnus rubra* Bong. in Washington and elsewhere.

Cortinarius (Telamonia) evernius Fr.
(Fig.9)

In the European literature the name *C. evernius* has long been applied to a taxon with a rather strong odor of radish. Fries (1863), however, emphasizes that this species has no odor ("odor haud notabilis"). Moser (1967) pointed out that, as a matter of fact in the area of Femsjö the taxon described by Fries is very common and lacks any odor of radish. The taxon with radish odor is certainly close to the taxon of Fries and can not be separated at a species level, but deserves the rank of a variety or form.

Material collected at Barlow Pass, Washington, agrees fully with the original description of Fries and with that given by Moser (1967) based on material from the Femsjö area. The characteristic features of the species are the dark brown pileus when moist, the very pale pileus color when faded, the purplish brown color at first of the rather wide and distant lamellae, the long, violet stipe which is normally cylindric to tapering, rarely slightly enlarged at the base and the lack of a radish odor.

M i c r o s c o p i c c h a r a c t e r s: Spores $8.7\text{--}11.3 \times 5\text{--}6.5$, mean = 10 ($S = 0.67$) $\times$ $5.5 \mu\text{m}$ ($S = 0.3$), $Q = 1.8$, volume 113-245, mean = 172 ($S = 27.5$), ellipsoid to almondshaped, verrucose.

H a b i t a t: on mossy ground in conifer forests under *Abies amabilis*, *lasiocarpa* and *Tsuga heterophylla*.

Collections examined: IB 89/329, Barlow Pass, Sauk River, Snohomish Co., Washington, 27-08-1989; IB 89/385, JFA 10014, Steven's Pass near Ski area, King Co., 01-09-1989.

C o m m e n t: A. H. Smith's collection 29879, Lower Tahoma Creek, Mount Rainier National Park, Washington, 06-08-1948, leg. E. Knowless, D. E.

Stuntz and E. G. Simmons seems to belong to this taxon. The spores are of the same size and shape and have coarse ornamentation. A collection of C.H. Kauffman, Leal Colorado, 24-08-1917, identified as *C. evernius* has slightly broader spores with very faint verrucosity and seems to belong to a different taxon.

Cortinarius (Telamonia) umidicola Kauffm. (1905)
(Fig. 10,11,12)

Synonym: *Cortinarius canabarpa* Moser (1966)

Misapplied name: *Cortinarius plumiger* Fr. ss. Kauffm. p.p. (1918)

P i l e u s 4-12.2 cm in diameter, hemispherical, convex, then expanded applanate and sometimes with an umbo or slightly depressed, moderately hygrophanous, pale grayish brown, center in young specimens ochraceous, Ecru Drab(R) or near Light Cinnamon Drab (R) to Avellaneous (R), later becoming darker, disc gradually more brownish, brown to Cinnamon Buff (R), margin sometimes with violaceous tinge when young, in moist condition surface somewhat darker brown, eventually Mikado Brown (R) or somewhat darker, young pilei covered by the strongly developed veil, which is at first grayish white, later margin often with patches of pale grayish veil remnants, becoming brownish with age.

L a m e l l a e when young gray-brown with a mixture of Cinnamon Drab (R) and Army Brown (R), with a reddish brown tinge (Mu 5YR5/4), then gray-brown, Sayal Brown (R), eventually deeper brown, brown mixed with Cinnamon (R) or Chestnut (R), edges serrulate, shallowly emarginate, subdistant, L about 60, l=1-3, 10-12/cm at the margin, 8-12 mm broad (= 4-5 x the thickness of the pileus context).

S t i p e clavate, 6-12 cm long, 10-21 mm in the upper part, base 17-40 mm thick, clavate to clavate-bulbous or bulbous, apex pale, grayish, in young specimens also with a slight bluish cast, coated with soft white fibrils, lower surface similar but often pale grayish brown, longitudinally fibrillose, at first with thick, loose, grayish, fibrillose veil which later may form one or several grayish brown, sometimes incomplete belts.

C o n t e x t 10-16 mm thick on the disc, thin over the lamellae, watery pale Brownish Drab (R) mottled with white, then pale grayish brown or whitish with watery brown areas when faded, in stipe in younger specimens with a slight bluish tinge in the apex and cortex, whitish centrally above, below watery. No special odor or slightly pungent to subraphanoid. Taste mild.

C h e m i c a l r e a c t i o n s: KOH only slowly grayish brown on the pileus surface, dark brown to blackish on the context.

M i c r o s c o p i c c h a r a c t e r s: Spores 8-10(-10.8) x 5.3-6(-6.6) μm , mean 9 (S = 0.46) x 5.6 (S = 0.23) μm , Q = 1.6, (S = 0.09), volume = 119-188, mean = 147 (S = 15.84), ellipsoid, verrucose, basidia 32-34 x 8-8.5 μm , 4-spored, clavate. With clamp connections.

H a b i t a t: in subalpine conifer forests under *Picea engelmannii* and *Abies lasiocarpa* among mosses and *Vaccinium* spp.

Collections examined: **Idaho**: Smith 82042, Beaver Creek, Priest Lake, Bonner Co., 17 Sept 1972 (as *C. plumiger* Fr.); **New York**: Freeville, Tompkins Co., leg. C.H.Kauffman 22 Aug 1904 (holotype of *C. umidicola* Kauff.); North Elba, Adirondack Mts. lehg. Kauffman 14 Sept 1914 (as *C. plumiger* Fr.); **Washington**: IB 89/414, IB 89/415, and JFA 10031, Trailhead to Easy Pass, Skagit Co., 03 Sept 1989.

The species has been observed in several places in this area.- In Wyoming we observed a more violaceous form of the species (Moser, McKnight and Ammirati 1995). **Europe:** (as *C. canabarba* Mos.) IB 66/274, Gottschuchen, Carinthia, Austria. IB 78/280, Liikasenvaara near Oulanka, Finland; IB 85/181, Jämtland, Sweden.; IB 22 Sept 1988, Seiseralp, South Tyrol, Italy (leg. G. and H. Keller).

C o m m e n t s: The species was described by the senior author under the name *C. canabarba* (Moser 1966) from Carinthia, Austria. Later it became known from northern Finland (Kuusamo) and Jämtland in Sweden and finally, from South Tyrol (Italy). The discovery of two paintings of C. H. Kauffman of his *C. umidicola* and a comparative study of the types convinced us of the identity of the two species. *Cortinarius canabarba* Mos. becomes thus a synonym of *C. umidicola* Kauffm. Kauffman collected the fungus in the Appalachian Mountains. The holotype comes from Freeville, Tompkins Co, NY, 22 Aug 1904. The spores of the type are of the same size and shape but slightly more verrucose than in *C. canabarba*.

M i c r o s c o p i c c h a r a c t e r s of the holotype: Spores 8-10(-10.7) x 5.3-6.5 μ m, mean 9 (S = 0.47) x 5.7 (S = 0.3), Q = 1.4-1.7, mean 1.6 (S = 0.08), V = 119-223, mean = 155 (S = 22.6), basidia 31-34 x 8-8.5 μ m, clavate, 4-spored; surface of pileus with few layers of hyaline hyphae, 4-5(-7) μ m wide with clamp connections, epicuticular hyphae 8-14(-15) μ m, walls yellowish, hyphae of the hypodermium inflated to 20 μ m, hyphae of the stipe cortex 7-12 μ m, walls yellowish, hyphae from the veil (from stipe) 5-6(-7) μ m thick, with clamp connections. A second collections of Kauffman came from Houghton, Michigan, 22 Jul. 1906, collected in maple and birch ravines. This is different from the typical habitat. The spores are more heterogeneous and seem partly immature. Also the painting is less convincing. A collection of H.E. Bigelow det. A.H. Smith (Smith 48279) from Mt. Rainier National Park, Washington, has similar smaller spores but is still in the range of variability for *C. umidicola*. In addition there are some cheilocystidia. However, some banal, mostly cylindric to clavate types of sterile cells in *Telamonia* are a rather inconstant character and depend often on weather conditions during the development of the basidiomata. There is also a painting by C.H. Kauffman under the name "*C. plumiger* Fr." from North Elba, Adirondack Mountains, under spruce and birch, 14-09-1914. This collection is strikingly similar to *C. umidicola* and the spores agree well with those of *C. umidicola*. The protologue of Fries for *C. plumiger* differs, however, in several points. Fries calls the veil "candidus" and the squamules on the pileus "floccose-plumosis densis albis", the color of the pileus "udus fuscescens subolivaceus, siccus testaceo-alutaceus" which suggests a much stronger hygrophany as observed in *C. umidicola*.

It is interesting to note that Kauffman (1918) writes of *C. umidicola*: "This species is probably identical with one occurring in Europe. I collected a very similar plant with the same gregarious habit, near Stockholm, Sweden, while in company with Romell, Maire and Pelteaux, who did not recognize it as a species definitely known to them." He discusses then the possibility of an identity with *C. lucorum* Fr. and in North American Flora (1932) he synonymizes *C. umidicola* with *C. lucorum* Fr. The label on a collection under the name *C. lucorum* Fr. made by Kauffman near Stockholm on 7 Sept. 1908 and determined by R. Maire includes the following remarks: "*C. umidicola* Kauff. is identical, C. H. K.- Romell did not know it. Maire later suggested the name for another collection, and it seems to be the plant and not *C. impennis*." In the European literature we find at least two different interpretations of *C. lucorum*. Neither of them corresponds to *C. umidicola*.

Table 1. Comparison of spore measurements for *C. umidicola*, *C. canabarpa* and *C. plumiger* ss. Kauffman.

collection	measure	maximum	minimum	Q	V
<i>C. umidicola</i>					
Holotype	9.0x5.7	10.7x6.5	8.0x5.3	1.6	155
Smith 48279	8.8x6.0	9.7x6.5	7.7x5.3	1.5	167
<i>C. plumiger</i> ss. Kauffm.	9.8x5.5	10.8x6.0	8.0x5.3	1.8	157
<i>C. canabarpa</i>					
IB 89/414, Washington	9.4x5.9	10.3x6.0	8.0x5.3	1.6	149
f. <i>coerulea</i> IB 91/391 , Wyoming	9.4x5.9	10.3x7.0	8.6x5.3	1.6	173
IB 85/181 Jämtland, Sweden	9.9x6.4	10.9x6.8	9.1x5.3	1.6	210
IB 66/274 Carinthia, Austria topotype	9.5x6.4	10.3x7.0	8.8x5.9	1.5	204
21/09/88 Seiseralp South Tyrol. Italy	9.8x6.3	10.6x7.0	8.8x5.9	1.6	205
IB 78/280 Finland	9.4x6.7	10.0x7.0	8.8x6.2	1.4	213

Cortinarius (Telamonia) badiovinaceus Mos. (1965)
(Fig.13,14, 15)

Syn.: *Cortinarius nigrellus* Peck var. *occidentalis* A.H.Smith (1944)

P i l e u s 1.9-6.5 cm in diameter, convex to somewhat campanulate, sometimes more or less conic, then umbonate to nearly plano-umbonate, hygrophanous, margin at first incurved, then nearly plane, not translucently striate when moist, dark vinaceous brown, Cameo Brown (R) to Walnut Brown (R), Burnt Umber (R) to Carob Brown (R) over the central part when moist, margin paler in dry condition, Vinaceous Russet (R), margin Cacao Brown (R), Pecan Brown (R), Mikado Brown (R), the very margin still paler (Cinnamon (R) or more brownish),

drying centripetally, the margin often with a thin coating of a pinkish pale veil.

L a m e l l a e yellow rust-brown, Light Ochraceous Tawny (R) to Ochraceous Tawny (R), later richer brown to rust colored from spores, deeply emarginate, edges eroded, close to subdistant, L about 35, l = 1-3, 17/cm at the margin, 4-8 mm broad (5-6 x thickness of the pileus context).

S t i p e 3-6 cm long, 5-10 mm in upper part, base 5-14 mm thick, clavate or even somewhat fusoid, pallid to dingy whitish, Light Pinkish Cinnamon (R), with one or occasionally several belts and patches of the universal veil colored vinaceous brown, Vinaceous Russet (R) below the white cortina. Basal area whitish or somewhat sordid.

C o n t e x t 3.5-6 mm thick on the disc, solid, thin and subfragile over the lamellae, stipe with firm cortex and softer pith, in pileus brownish buff, pale brownish, yellow brownish when dry, light umber when wet, whitish in the stipe cortex in young specimens. Without particular odor (slightly fungacious), taste mild.

C h e m i c a l c h a r a c t e r s: KOH dark brown in the context and grayish brown to dark brown on the cuticle.

M i c r o s c o p i c c h a r a c t e r s: Spores 6-8 x 4.5-6 μm , mean = 7 (S = 0.43) x 5.4 (S = 0.35); Q = 1.3, volume 68-144, mean = 99.5 (S = 18.4), subglobose to broadly elliptic, verrucose. Basidia 38-40 x 7.5-8.4 μm , 4-spored clavate. Cheilocystidia absent. Epicuticular hyphae 7-8 μm , walls yellow-brown, finely encrusted; hypodermium hardly differentiated. Clamp connections present. (The spores of the holotype of *C. badiovinaceus* Mos. measure 6.2-7 x 4.3-5.3 μm , of the holotype of *C. nigrellus* var. *occidentalis* A.H. Smith 6-7 x 4.7-5.8 μm).

H a b i t a t: Under *Abies lasiocarpa* and *Pseudotsuga menziesii*, gregarious in moist litter.

Collections examined: **Washington**: IB 89/335, JFA 9991, Stevens Pass, King Co., Washington, 28 Aug. 1989, leg. M. Moser & J. Ammirati. Observed but not collected later in the same area. A. H. Smith 17304, Mt. Angeles, Olympic Mountains, 24 Sept 1941 (holotype of *C. nigrellus* var. *occidentalis* Smith). **Europe**: IB 50/61 (holotype of *C. badiovinaceus* Mos.), Vikartal, Tyrol, 20 Aug. 1950. IB 67/75, Voldertal, Tyrol, 26-08-1967. IB 70/191 and 70/191b, Hågnan, Femsjö, Sweden, 12-09-1970 and 14-09-1970.

C o m m e n t s: The specimens from the Cascade Mountains agree fully with European material. The dark color of the pileus is typical and contrasts with the relatively bright lamellae. The vinaceous brown universal veil and the rather small, subglobose spores are also characteristic. These are all characters given by A.H.Smith (1944) for his *C. nigrellus* var. *occidentalis*. A study of the holotype confirmed the identity. This raises the question of priority. If the taxon is really a variety of *C. nigrellus* Peck, Smith's name would have priority. We have not seen the type of Peck. Kauffman (1932) gives spores measurements of 7-7.5 x 4-5 μm , in a collection of A.H.Smith (4912) we found ellipsoid to almond-shaped spores of 8-10 x 4.8-5.4 μm . The descriptions of Peck and Kauffman seem to indicate, that the small spores are the only character which the two taxa have in common. There are, however, many characters (color, vinaceous veil, size) which favour separation at the species level. In this case *C. badiovinaceus* Mos. (1965) has priority.

Cortinarius (Telamonia) impolitus Kauffm.(1918)
(Fig.16,17,18,19, 24,25,26)

Syn. *C. fusisporus* Kühner (1955) (?)

C. belleri Mos. (1983) (?)

Misappl. name: *C. incisus* ss. Fr. (1836, 1863, 1884), Nathorst-Windahl (1958), Moser (1983), non Pers.

P i l e u s 1-3 cm in diameter, convex, sometimes umbonate, finally applanate, hygrophanous, margin in moist condition not striate but often splitting on drying, surface sometimes breaking into fine, appressed squamules, dark red-brown Caill (49S), often also darker umber brown (Caill 50S), drying centrifugally and becoming yellow-brown (near Caill 57N, somewhat paler than Ochraceous Tawny (R)).

L a m e l l a e brown, grayish brown, Sayal Brown (R) to Tawny Olive (R), edges strongly eroded, 2-5 mm broad (3-5 times thickness of pileus context), close to substant, L=30-35, l=1-3, 12-13/cm at the margin, adnate to shallowly emarginate.

S t i p e 1.5-3.5 cm long, 3-7(-9) mm thick, equal to slightly enlarged toward the base, pale yellowish brown, lower part with remnants of the whitish universal veil.

C o n t e x t pale brownish, ochraceous brownish, darker mottled in the stipe. Odor fungacious, taste mild.

C h e m i c a l c h a r a c t e r s : KOH black on the pileus surface and context.

M i c r o s c o p i c c h a r a c t e r s : Spores $7.7-10 \times 4.3-5.3 \mu\text{m}$, mean $8.9 (S = 0.73) \times 4.9 (S = 0.3) \mu\text{m}$, $Q = 1.8$, volume 75-148, mean 112 ($S = 17$). Basidia $30-34 \times 7.7-8.5 \mu\text{m}$, 4-spored, clavate, some with yellow-brown content.

H a b i t a t : Under *Abies lasiocarpa*, along border of a gravel road, often growing in fascicles.

Collection examined: **Washington** :IB 89/386, Stevens Pass, King Co., 1 Sept. 1989; **Wyoming** : Smith 35310 (as *C. rigidus* Fr.) North Fork Little Laramie , Medicine Bow Mountains, 29 Jul. 1950; **New York** : 7th Lake, Adirondack Mts., leg. Kauffman Sept. 1921, **Michigan** : New Richmond, leg. Kauffman 19-09-1912 (holotype), Smith 7653, Bears Lake, Oakl. Co., 4 Sept. 1937, Forestry Farm, Ann Arbor, leg. Kauffman 23 Aug. 1925

Europe : (as *incisus* ss. Fr., Mos.) 65/25 Belgium ; 64/79, Femsjö, Sweden, 70/241 Femsjö, Sweden, 87/389 Femsjö, Sweden; 70/297 Kirkeby, Denmark; Shaffer 5318 (as *C. fusisporus* Kühn.), Ermenonville, Oise, det. Romagnesi,

C o m m e n t s : Moser (1983) interpreted this taxon as *C. incisus* in the sense of Fries. The reasons for so doing are: it shows the macroscopic characters assigned to it by Fries very well, the figure given by Fries in Icones pl.160,1 comes from Femsjö material and this taxon is not rare in that area even today. Also Nathorst-Windahl (1958) had the same concept. Other species with similar macroscopic characters but different spore types could not be found around Femsjö during the last forty years. However, *C. incisus* is not a species of Fries but was first described by Persoon. The short description of Persoon does not permit a positive interpretation. In consequence the concept of this taxon in the literature is rather confused. The spore measurements given by different authors vary greatly, e.g. Bresadola : $9-12 \times 5-7 \mu\text{m}$, R.Henry $10 \times 8 \mu\text{m}$ (but according to measurements by Kühner on material of Henry $7-9 \times 5-5.5 \mu\text{m}$), Kühner & Romagnesi $8.5-9.5 \times 5-5.5 \mu\text{m}$, J.E.Lange $7-7.5 \times 4-4.5 \mu\text{m}$, Moser in earlier interpretations $7.5-9 \times 4-5 \mu\text{m}$, Quelet "pruniform, $10 \mu\text{m}$ long, Rea $8-9 \times 5-6 \mu\text{m}$. Ricken gives spores of $8-9 \times 5-6 \mu\text{m}$, but his fungus is a larger

one.

If one should consider *C. incisus* as a nomen confusum, the next available name seems to be *C. impolitus* Kauff. 1918. The above described collection from Washington agrees well with the concept of *C. incisus* of Moser (1983), based on material collected in the Femsjö area in Sweden. The spores have the characteristic slender shape, but slightly smaller, however, the measurements are overlapping. Moreover we have only seen a single collection from America, so we can not judge the range of variability. Other collections by Kauffman and A.H. Smith under this name have somewhat larger spores as can be seen from table 2. Also in Europe the species is often found on rather dry habitats, sandy soils or road sides. The taxon described by Kauffman (1932) under the name *C. incisus* is different. However, a study of the holotype and other collections of *Cortinarius impolitus* Kauffm. revealed that it is conspecific with *C. incisus* ss. Fr., Mos. This is corroborated by the shape and size of the spores of the holotype (8-11 x 4-4.7 μ m) and the habit and color of the basidiomata and the habitat.

In the literature we find descriptions of several small species of *Telamonia* with fusoid spores, all with somewhat similar macroscopic characters: *C. impolitus* Kauff., *C. fusisporus* Kühn. (1955), *C. belleri* Mos. (1983) (= *C. longisporus* Beller (1982) nom. illeg.), *C. incisus* ss. Fr. (1836-38, 1863, 1884), Nathorst-Windahl (1958), Mos. 1983 non Pers., *C. semivestitus* Mos. (1967), *C. lux-nymphae* Mel. (1989), *C. heterosporus* Bres. in Henn. (1885), *C. scobinaceus* Mal. & Bert. (1970). The question arises whether all these taxa or some of them are conspecific or whether they or some of them represent distinct but closely related taxa. The macroscopic characters show not very much variation. *C. semivestitus* differs by a strongly developed, ochraceous veil consisting of relatively thick hyphae (5-11 μ m) with yellowish walls. All others have white veils with hyphae of 3-7 μ m broad. *C. lux-nymphae* has significantly smaller spores (6.5-8.5 x 3-3.5 μ m). *C. heterosporus* Bres. has very slender spores of (7)-7.5-10.5 x 2.5-3.7 μ m and has at the base of the stipe small reddish ochraceous to brick- or fire-red floccose-fibrillose squamules. In a collection made by C. Bas from the Netherlands (Bas 4789) we found spore measurements of (7)-7.5-10.5 x 2.5-3.7 μ m and the red hyphae from the base of stipe 5-7(-8) μ m wide with intracellular, but evidently not anthraquinonic pigment. The pileus colors are vinaceous to purple brown. And *C. scobinaceus* seems to belong to the group of *C. psammocephalus*, *strobilaceus*, to judge from the original description and own recollects from the mediterranean area. These four taxa can seemingly be excluded from the complex.

C. impolitus Kauff., *C. incisus* ss. Fr., Mos., and *C. belleri* are species from $\pm$ dry habitats, often sandy or loamy soils. They are described with finely squamulose to scaly pileus surface, with short stipes and often growing fasciculate. Unfortunately the holotype of *C. fusisporus* was not available while we have prepared this publication. Kühner reports it from a site under conifers among heather and indicates a glabrous pileus surface and a relatively longer stipe. Are these differences only due to phenetic responses to growth under different ecological conditions? This is a question which hardly can be answered on the basis of macro- and microscopic observations. Perhaps molecular data can solve such problems in future.

C. belleri can be interpreted as an ecological variety or subspecies growing under *Cistus*. Bon (1986) declared the name *C. belleri* (= *C. longisporus* Beller 1982) as a nomen superfluum, because he regarded *C. longisporus* (Murr.) Singer as an invalid name. However, he has overlooked, that Singer made this combination not 1962 but

already in Lilloa vol.22, 1949 (publ.1951), i.e. before 1 January 1953. Thus the combination of Singer is valid and *C. longisporus* Beller becomes a later homonym and illegitimate.

Table 2. Spore measurements of different collections of *Cortinarius impolitus* Kauff., *C. incisus* ss. Fr., Mos., *C. fusisporus* Kühn., *C. semivestitus* Mos., *C. belleri* Mos. (DK = Denmark, F = France, SF = Finland, S = Sweden)

Collection	mean	max	min	Q	V
<i>C. incisus</i> 89/386 S	9.0x4.9	10.0x5.3	8.0x4.3	1.85	114
<i>C. impolitus</i> Smith 7653 USA	9.1x4.6	10.0x5.0	8.5x4.1	2.0	101
<i>C. impolitus</i> Smith 5001 USA	9.2x4.3	10.3x4.7	8.2x4.1	2.3	73
<i>C. impolitus</i> Kauff.7th Lake USA	9.4x4.3	12.3x5.3	8.2x3.8	2.2	93
<i>C. impolitus</i> HT,Kauff. New Richmond USA	9.5x4.4	10.9x4.7	7.9x4.1	2.2	97
<i>C. semivestitus</i> 79/493 S	9.7x4.2	10.6x4.6	9.1x3.8	2.3	92
<i>C. semivestitus</i> 74/355 S	9.8x4.4	10.6x4.7	8.8x4.1	2.0	78
<i>C. rigidus</i> Smith 35310 USA	9.9x4.4	11.5x4.7	8.8x4.1	2.2	100
<i>C. incisus</i> 79/297 DK	9.9x4.6	11.2x5.1	8.5x4.1	2.2	109
<i>C. fusisporus</i> , Söderholm 1531 SF	10x4.7	7.9x3.5	8.8x4.0	2.2	75
<i>C. semivestitus</i> HT 57/41 S	10.2x4.4	11.2x4.7	9.1x4.1	1.9	81
<i>C. fusisporus</i> Shaffer 5318 F	10.2x4.4	11.5x4.7	8.5x4.1	2.3	103
<i>C. semivestitus</i> 89/307 S	10.4x4.3	12.1x4.7	9.1x4.1	2.4	102
<i>C. impolitus</i> , Kauff. For.Farm.25 USA	10.5x4.4	13.5x4.7	8.8x4.0	2.0	78

<i>C. incisus</i> 87/389 S	10.5x4.3	11.8x4.7	9.1x4.1	2.2	81
<i>C. incisus</i> 79/241 S	10.6x4.3	12.1x4.7	9.7x4.1	2.5	104
<i>C. belleri</i> 81/507 F	10.6x5.1	12.9x5.9	9.4x4.7	2.1	148
<i>C. incisus</i> 64/79 S	11.4x4.8	13.5x5.3	9.4x4.1	2.4	113
<i>C. impolitus</i> , Smith 1929 USA	11.2x5.6	13.5x6.5	10.0x5.0	2.0	185
<i>C. belleri</i> 80/621 F	11.5x5.0	13.5x5.9	10.3x4.4	2.3	153

Cortinarius (Telamonia) chrysomallus Lamoure (1977)

This species has been recorded before from the United States from **Wyoming**, where it is rather frequent in the alpine and subalpine zone in the Greater Yellowstone area (Moser & McKnight 1987, Moser 1993). It has also been found in the coastal dunes in **California** associated with *Salix hookerianus*. Below are the first reports for **Washington**:

IB 89/356, IB 89/356b, JFA 9997, Lake Ann above Rainy Pass, Chelan Co., under shrubby *Salix* sp. (*latifolia* ?) in subalpine habitat, leg. M.Moser, J.Ammirati, J.Trappe, D. Luoma and E. Cazares, 29-08-1989.

Acknowledgements : We wish to express our gratitude to the Daniel E.Stuntz Memorial Foundation for support for travel to the collecting sites and support for the senior author. The senior author thanks also the Alexander H. and Helen V. Smith Fund for support for studies in the Herbarium at Ann Arbor. Finally we want to thank Prof. Harry D. Thiers and Prof. Orson K. Miller Jr. for reviewing and improving our manuscript.

Literature cited .

- BLATTO, L., 1982, Atlante fotografico dei funghi. Ed. U.Hoepli, Milano
 BELLER, J., 1982, Espèces nouvelles.- Doc. Myc. 12 (46):32
 BON, M. 1986, Validations, mises au point nomenclaturales et autorités dans le genre *Cortinarius*.- Doc. Myc. 16 (63-64): 62
 BRANDRUD, T.E, H.LINDSTRÖM, H:MARKLUND, J.MELOT, S.MUSKOS, 1989, *Cortinarius* Flora fotografica I.. Ed. Fotoflora
 - - 1992 part II. Ed. Fotoflora
 CETTO, B., 1987, I funghi dal vero, vol.5. Saturnia Trento
 FRIES, E., 1836-1838, Epicrasis Systematis Mycologici. Uppsala

- FRIES, E., 1863, Monographia Hymenomycetum Sueciae, vol.II. Uppsala
- FRIES, E. 1878-84, Icones selectae fungorum.II. Uppsala.
- HENNINGS, P. 1890, Die in der Umgebung Berlins bisher beobachteten Hymenomyceten.- Verh. Bot. Ver. Prov.Brandenburg 31:141-178
- HENRY, R.,1951, Les Scauri.- Bull.Soc. Myc. de France 67:225-322
- KAUFFMAN, C.H. 1905, The genus *Cortinarius*: a preliminary study.- Bull.Torr. Bot.Club 32:301-325
- 1918, The Agaricaceae of Michigan. Vol.I. Mich. Geol. and Biol.Survey Publ.26, Biol.Ser.5, Lansing, 1-924
 - 1932, *Cortinarius*. In North Amer. Flora, 10 (5): 232-348
- KÜHNER, R., 1955, Complements a la "Flore Mycologique" IV. Espèces nouvelles ou critiques de *Cortinarius*.- Bull.Soc. Linn. Lyon, 24 (2):39-54
- LAMOURE, D. 1977, Agaricales de la zone alpine. Genre *Cortinarius* Fr. sous-genre *Telamonia* (Fr.) Loud. 1.- Trav. Scient. Parc. Nat. Vanoise 8:115-146
- MALENCON,G., R.BERTAULT ,1970, Flore des champignons superieurs du Maroc.Vol.I. 601 pp. Rabat.
- MAZZA, R.,1992, *Cortinarius blattoi* nov. sp.- Boll. Circ. Mic. "Giovanni Carini" 23:13-22
- MELOT, J.1989, Combinationes et taxa nova.- Doc. Myc. XX (77): 93-100
- MOSER,M., 1952, Cortinarien-Studien I. *Phlegmacium*. Sydowia VI:17-161
- , 1965, Studien zur Gattung *Cortinarius* Fr. subgen. *Telamonia* sect. *Armillati*. Schweiz. Zeitschr. f.Pilzk. 43 (8):113-124
 - , 1966, Einige interessante Pilzfunde aus dem Gebiet von Gottschuchen. Carinthia II, Mitt. Naturw. Verein f.Kärnten, Bd. ?? 28-33.
 - , 1967 , Neue oder kritische Cortinarien Arten aus der Untergattung *Telamonia* (Fr.) Loud.- Nova Hedwigia 14:483-518
 - , 1983, Notizen zu einigen Cortinarien aus der Untergattung *Telamonia*. - Mycol. Helv.I(1):1-16
 - , 1993. Studies on North American Cortinarii III. The *Cortinarius* flora of dwarf and shrubby *Salix* associations in the alpine zone of the Windriver Mountains, Wyoming, USA.- Sydowia 45(2):275-306
 - and E. HORAK, 1975, *Cortinarius* Fr. und verwandte Gattungen in Südamerika. Beih. Nova Hedwigia nr. 52, 628 S., Verl. J.Cramer, Vaduz
 - , K.MCKNIGHT and M.SIGL, 1994, The genus *Cortinarius* (Agaricales) in the Greater Yellowstone Area; Mycorrhizal host associations and taxonomic considerations. - In: Plants and their Environments: Psoceedings of the first biennial scientific conference on the Greater Yellowstone Ecosystems. Spt.16-17 1991, ed. D.G.Despain. Technical Report NPS/NRYELL/NRTR-93/XX: 239-246
 - , K.MCKNIGHT and J.F.AMMIRATI, 1995, Studies on North American Cortinarii I.New and interesting taxa from the Greater Yellowstone Area.- Mycotaxon 55:301-351
- NATHORST-WINDAHL, T., 1958, Acta Horti Gotenburgensis, 22(3):75-86
- QUÉLET, L. 1884. Quelques espèces critiques ou nouvelles de la Flore Mycologique de France. - C.R. Ass. franc. Av. Sci. (Rouen) 12.: 498-512
- SINGER, R. 1949 (publ.1951), The "Agaricales" (Mushrooms) in modern taxonomy. 1st. ed.- Lilloa 22:5-852
- SMITH, A.H. 1944, New and interesting Cortinarii from North

America.- *Lloydia* 7:163-235

VELENOSKY, J. 1922, *Ceske Houby*. - *Nakl. Cs. Bot. Spolecnost II*,:400-495

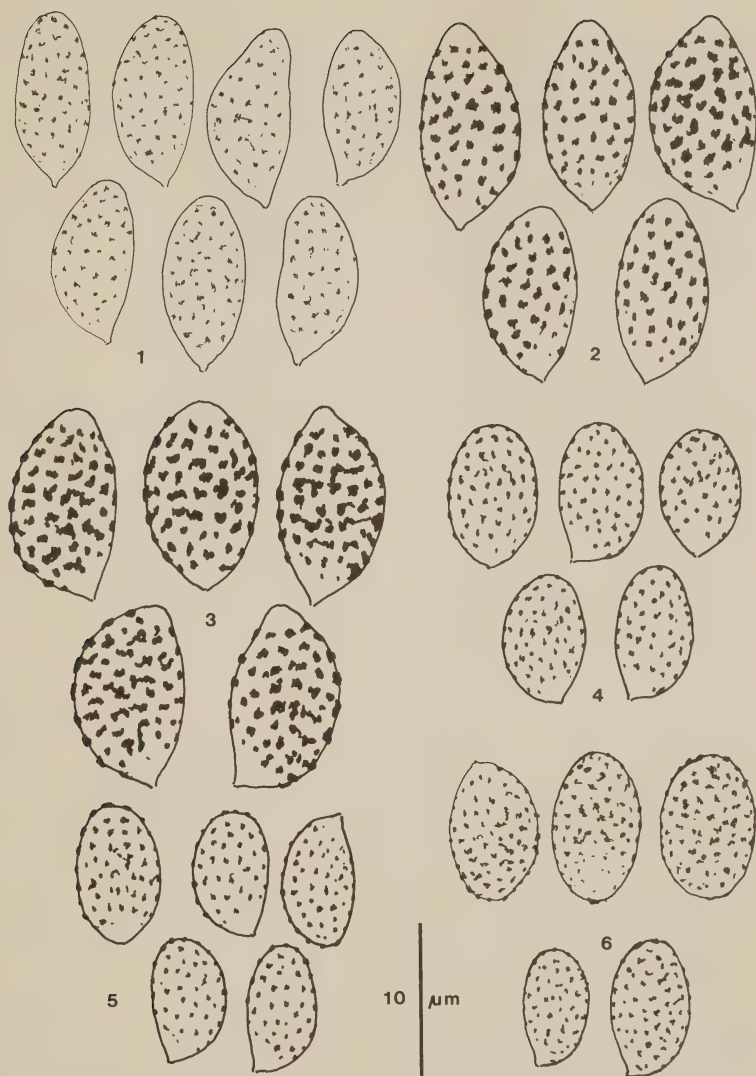


Fig. 1-6. Basidiospores of 1) *Cortinarius blattoi* (IB 89/353), 2) *Cortinarius albobrunnoides* var. *violaceovelatus* (IB 89/478), 3) *Cortinarius guttatus* (IB 89/463), 4) *Cortinarius alboviolaceus* (IB 89/490), 5) *Cortinarius griseoviolaceus* (IB 89/472) and 6) holotype Smith 17228. (All $\times 2000$)

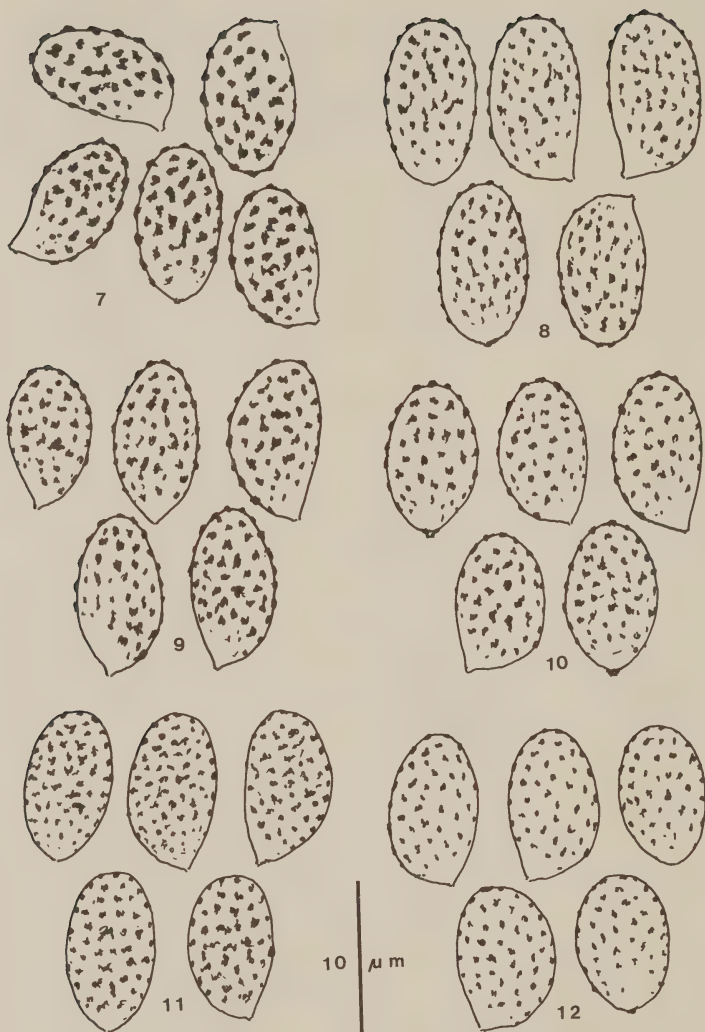


Fig. 7-12. Basidiospores of 7) *Cortinarius ionema* (IB 89/389), 8) *Cortinarius alnetorum* (IB 89/377), 9) *Cortinarius evernius* (IB 89/329), 10) *Cortinarius umidicola* (Kauffman Holotype Freeville, NY, 22-08-1904), 11) IB 414, 12) IB 66/274 (topotype of *C. canabarbæ*). (All x 2000)

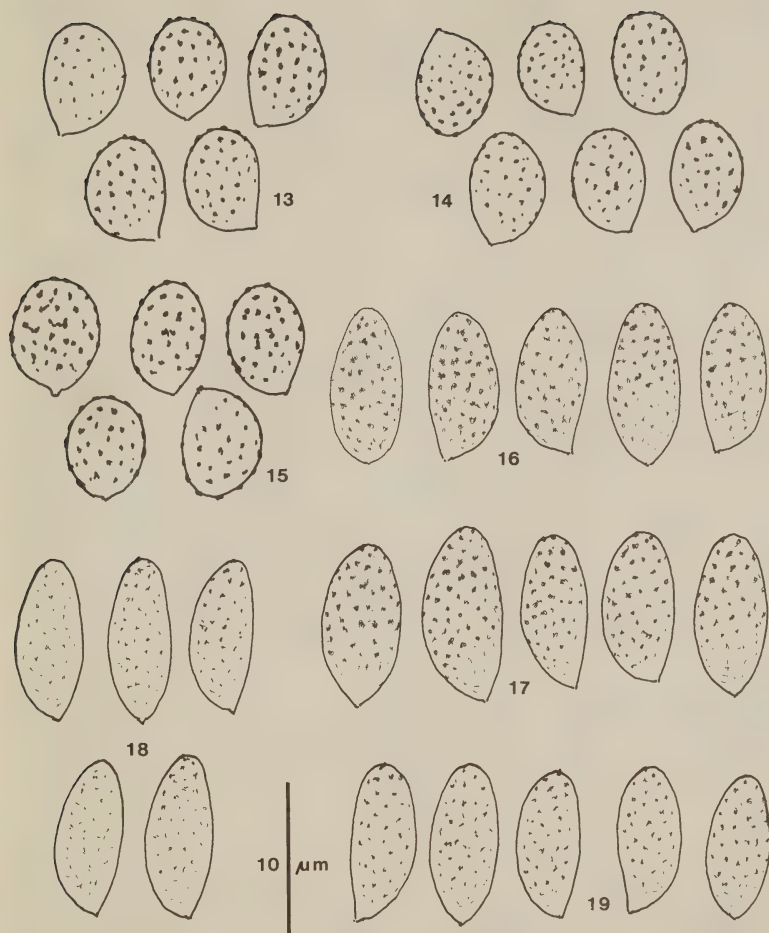


Fig. 13-19. Basidiospores of 13) *Cortinarius nigrellus* var. *occidentalis* (A.H.Smith Holotype 17307), 14) *Cortinarius badiovinaceus* (Holotype, IB 50/61), 15) IB 89/335, 16) *Cortinarius impolitus* (Kauffm., Holotype, New Richmond, 17) Kauffman, Forest Farm, Ann Arbor, 1925), 18) IB 89/386, 19) *Cortinarius fusisporus* Kühn. (Shaffer 5318, France) (All x 2000)

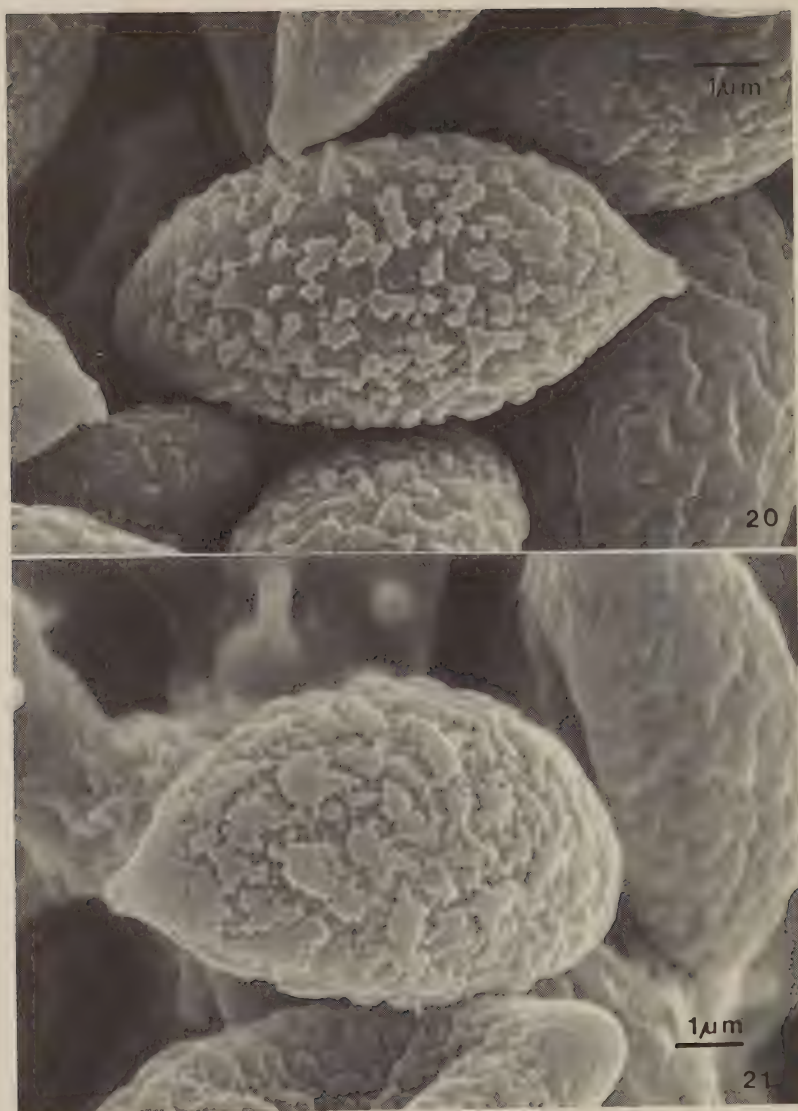


Fig. 20-21. SEM pictures of Basidiospores of 20) *Cortinarius blattoi* (JFA 9993, 21) *Cortinarius ionema* (JFA 10015)

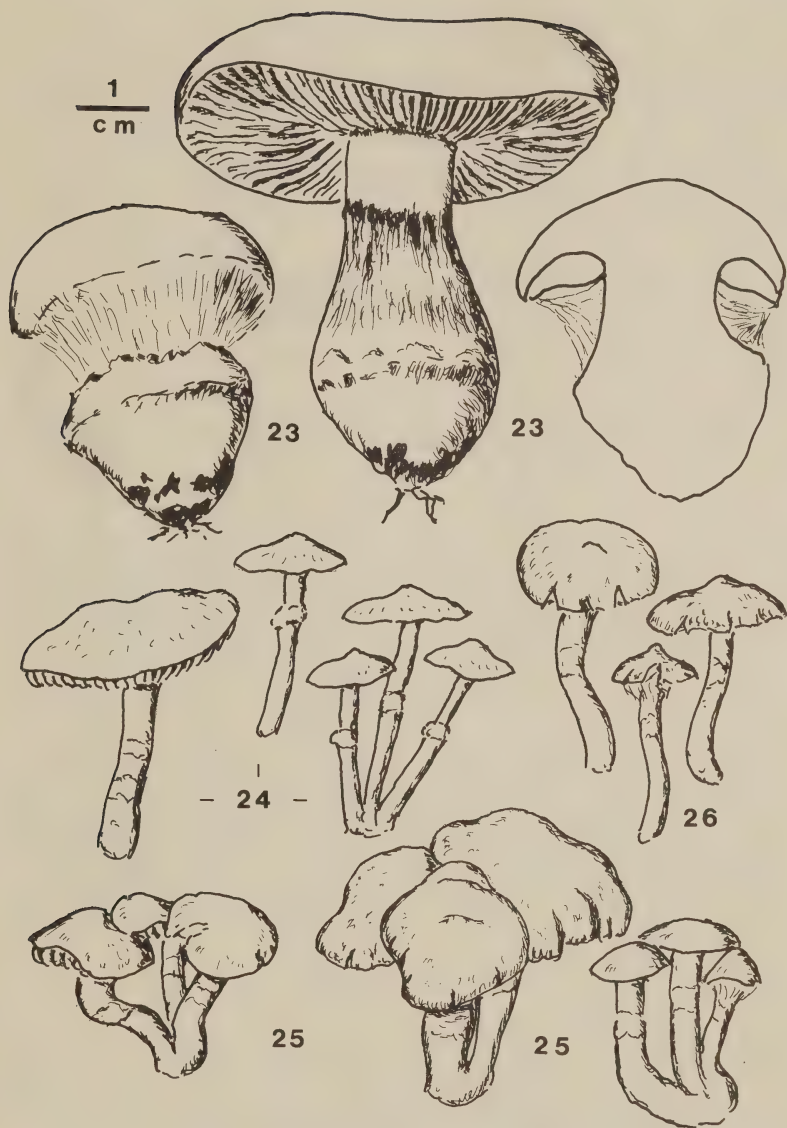


Fig. 23-26. Fruitbodies of 23) *Cortinarius albobrunnoides* var. *violaceovelatus* (IB 89/478), 24) *Cortinarius impolitus* (after painting of the holotype by C. H. Kauffman), 25) coll. 89/386. 26) coll. 87/389, (Sweden) (all nat. size)

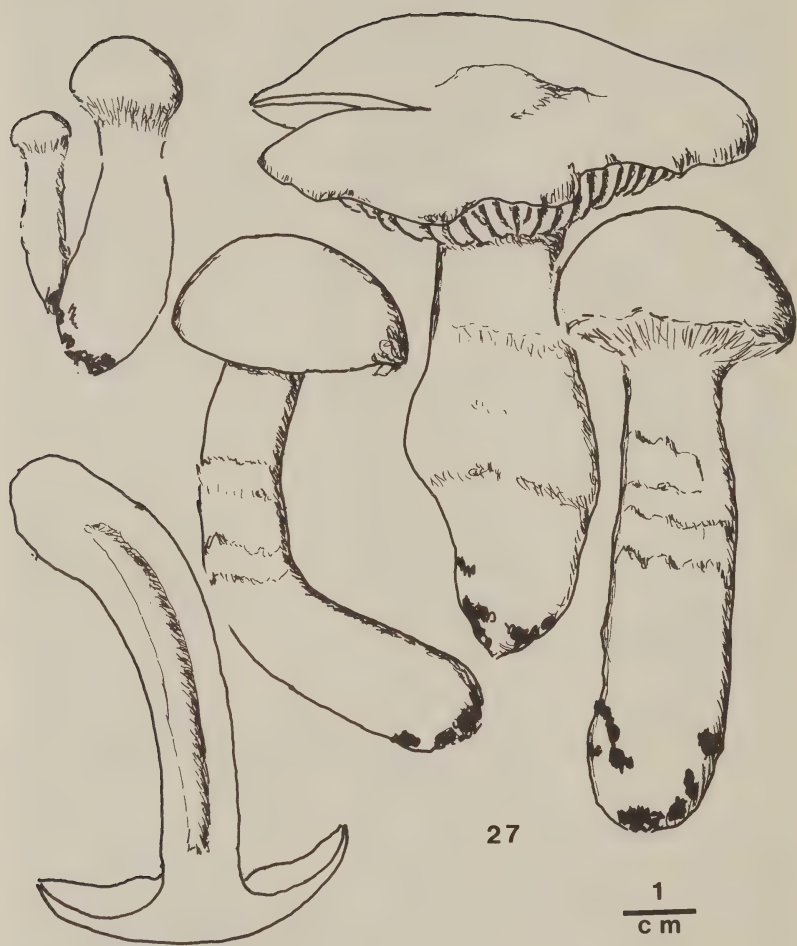


Fig. 27. Fruitbodies of *Cortinarius ionema* (IB 89/389 and 89/344) (Nat. size)

MYCOTAXON

Volume LVIII, pp. 413-417

April-June 1996

TAXONOMY OF DAEDALEA ROSEOLOA COMB. NOV.

ANJALI ROY

Department of Botany, Visva-Bharati University, Santiniketan 731 235,
West Bengal, India
and
A. B. DE

Department of Botany, Burdwan Raj College, Burdwan 713 104, W. B., India

SUMMARY

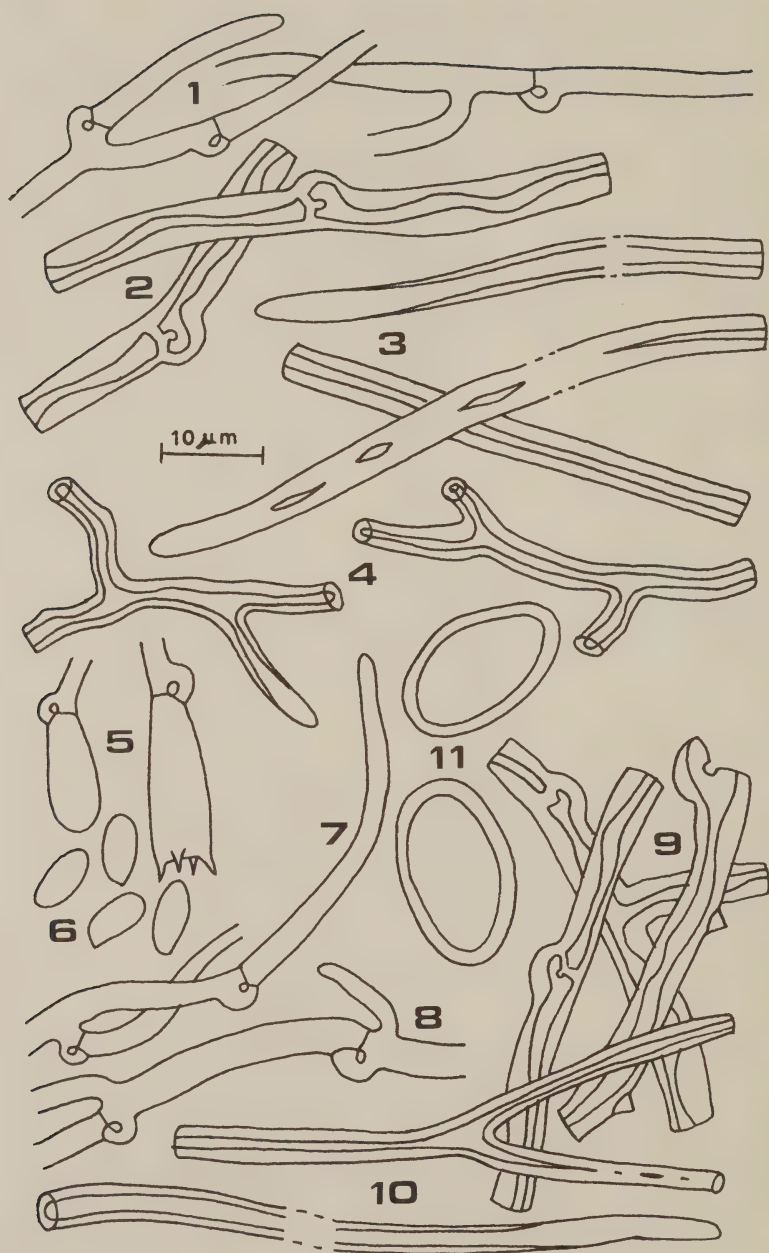
Detailed observations on morphological and cultural characters of Trametes roseola Pat. & Har. are given and in the light of these observations the taxonomy of the fungus is discussed. The new combination Daedalea roseola (Pat. & Har.) Roy & De is proposed.

INTRODUCTION

In India Trametes roseola Pat. & Har. commonly grows on dead hardwoods where it causes a brown rot. The fungus also occurs in Africa, Cambodia, Japan, Sri Lanka and Thailand (Bakshi 1971, Ryvarden & Johansen 1980). The present paper reports the results of detailed studies on the morphological and cultural characters of T. roseola. The taxonomy of the species is also discussed in the light of these findings.

MATERIALS AND METHODS

Observations were based on fresh specimens collected by the authors from Dehra Dun, U. P., India. Macroscopic characters of the basidiocarps were studied from free hand sections mounted in 10% KOH and stained with 1% Cotton blue. Cultures were established from context tissues of these basidiocarps and studied following the methods of Nobles (1948) and Nobles et al. (1957). Oxidase reactions were tested by the Bavendamm method as described by Davidson et al. (1938). Voucher specimens and cultures are maintained in the Mycological Herbarium of the Visva-Bharati University (VBMH).



DESCRIPTION OF BASIDIOCARP

Daedalea roseola (Pat. & Har.) Roy & De, Comb. nov.

= Trametes roseola Pat. & Har., Champ. Senegal, J. de Bot. 14:239, 1900 (Basionym).

Basidiocarp annual to perennial, pileus sessile, attached by a broad base, sometimes effused-reflexed, often imbricate, applanate, soft and corky when fresh, hard and rigid on drying, 5.5-6.5 x 4.0-5.0 x 1.2-1.5 cm; upper surface finely pubescent, smooth, azonate, pink brown when fresh, later becoming pale ochraceous buff to pinkish-cinnamon on drying; margin thick and rounded; context up to 1 cm thick, pinkish to pale ochraceous buff, corky, with occasional concentric darker zones; hymenial surface pinkish buff, pores circular or slightly angular, 5-7 per mm, pore tubes up to 5 mm long.

Hyphal system trimitic. Generative hyphae 1.5-5.0 μ m in diam., hyaline, clamped, thin-walled (Fig. 1) or thick-walled with irregular wall thickening (Fig. 2), a few solid, often with broken clamps. Skeletal hyphae (Fig. 3) hyaline to subhyaline, thick-walled to subsolid, unbranched, 2.3-7.0 μ m in diam. Binding hyphae (Fig. 4) hyaline, branched, thick-walled, 2.0-3.5 μ m in diam. Basidia (Fig. 5) clavate, 4-sterigmate, 10.0-15.0 x 4.5-5.5 μ m. Basidiospores (Fig. 6), hyaline, thin-walled, ellipsoid-cylindric, 4.5-6.5 x 2.5-3.0 μ m. SPECIMENS EXAMINED: VBMN 79791, 79792, 80793, 85794 and 92795 on unknown dead hardwoods.

ROT: Associated with brown rot.

DESCRIPTION OF CULTURE

Growth characteristics: Growth slow, covering the plate in 5 weeks. Advancing zone even, hyaline and appressed; aerial mycelium initially white, cottony to woolly, becoming woolly to farinaceous woolly in zones and light ochraceous buff to cinnamon buff in colour, traversed by faint radial zonations. Reverse bleached.

Oxidase reactions negative on both gallic acid and tannic acid agar.

Figs. 1-10. Daedalea roseola. 1-6. Microscopic structures from basidiocarp: 1. thin-walled generative hyphae; 2. generative hyphae with irregular wall thickness; 3. skeletal hyphae; 4. binding hyphae; 5. basidia; 6. basidiospores. 7-10. Microscopic structures from culture: 7. hypha from advancing zone; 8. thin-walled clamped aerial hypha; 9. clamped hyphae with irregular wall thickness; 10. fibre hyphae; 11. chlamydospores.

Microscopic characteristics: Advancing mycelium - hyphae hyaline, thin-walled, clamped, infrequently branched 2.2-4.5 μm in diam. (Fig.7). Aerial mycelium - (a) hyphae hyaline, clamped, 2.5-4.5 μm in diam., thin-walled (Fig.8) to thick-walled, often showing irregular wall thickening and solid refractive parts on walls (Fig.9); (b) fibre hyphae hyaline to subhyaline, thick-walled with narrow lumina, unbranched or occasionally branched, 2.5-3.5 μm in diam. (Fig.10); (c) chlamydospores ovoid or ellipsoid, 15.0-25.0 x 9.5-12.0 μm , hyaline, smooth, slightly thick-walled (Fig.11).

SEXUALITY: The result of pairing of 20 monosporous cultures obtained from a fresh basidiocarp (VBMH 92795) shows the species to be bipolar with the following distribution of mating types among the spores.

A1 : 1,6,10,11,16,17,18,20

A2 : 2,3,4,5,7,8,9,12,13,14,15,19

SPECIES CODE: 2.3.8.9.34.35.40.45.54 (following the system of Nobles (1965))
CULTURES EXAMINED: VBMH 79791, 80793, 85794 and 92795.

DISCUSSION

The species has been described as a member of the genus Trametes by different workers but Trametes roseola Pat. & Har. closely resembles Daedalea quercina L. ex Fr., the type species of the genus Daedalea Pers. ex Fr. Both T. roseola and D. quercina cause brown rots, produce no extracellular oxidase in culture, possess a bipolar type of sexuality and consist of thin-walled as well as thick-walled generative hyphae including generative hyphae with characteristic irregular wall thickening. It is to be noted here that, although Van der Westhuizen (1971), from comparative cultural and anatomical studies on D. quercina, concluded it to be a dimittic species, several workers including Cunningham (1948), Teston (1953), Kotlaba and Pouzar (1957), Domanski et al. (1973) and Ryvarden (1976) described the species as trimitic. In possessing a trimitic hyphal system T. roseola therefore closely resembles D. quercina, the type species of Daedalea. The species code describing the culture characteristics of D. quercina (Nobles 1965) also comes close to that of T. roseola. Thus so many features in common suggest a close relationship between T. roseola and D. quercina.

Therefore, it is concluded that T. roseola and D. quercina are congeneric, and T. roseola is transferred to Daedalea.

ACKNOWLEDGEMENT

The authors are greatly indebted to Dr.J.Ginns, Curator, National Mycological Herbarium of Canada, for critically reviewing the manuscript.

REFERENCES

- Bakshi,B.K.1971. Indian Polyporaceae (On Trees and Timber). Indian Council of Agricultural Research, New Delhi, India. 246 p.
- Cunningham, G.H. 1948. New Zealand Polyporaceae. 9. Trametes, Lenzites and Daedalea. D.S.I.R. Plant Disease Div. Bull. No. 80.
- Davidson, R.W., W.A. Campbell and D.J. Blaisdell. 1938. Differentiation of wood decaying fungi by their reactions on gallic acid or tannic acid medium. J. Agric. Res. 57:683-695.
- Domanski, S.H., H. Orlos and A. Skirgiello. 1973. Fungi. Warsaw.
- Kotlaba, F. and Z. Pouzar. 1957. Notes on classification of European pore fungi. Ceska Mykol. 11:152-170.
- Nobles, M.K. 1948. Studies in forest pathology VI. Identification of cultures of wood-rotting fungi. Can. J. Res., C. 26:281-431.
- Nobles, M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43:1097-1139.
- Nobles, M.K., R. Macrae and B.P. Tomlin. 1957. Results of interfertility tests on some species of Hymenomycetes. Can. J. Bot. 35:377-387.
- Ryvarden, L. 1976. The Polyporaceae of North Europe. Vol. I. Fungiflora, Oslo, Norway.
- Ryvarden, L. and I. Johansen. 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo, Norway.
- Teston, D. 1953. Etude de la differenciation des hyphes chez les Polypores dimidiés de la flora française. Ann. Univ. Lyon, Sci. Sect. C., 7:11-23.
- Van der Westhuizen, G.C.A. 1971. Cultural characters and carpophore construction of some poroid Hymenomycetes. Bothalia, 10:137-327.

VALSARIA AND NOTES ON *ENDOXYLINA*, *PSEUDOTHYRIDARIA*, *PSEUDOVALSARIA*, AND *ROUSSOELLA*

Yu-Ming Ju and Jack D. Rogers
Department of Plant Pathology
Washington State University
Pullman, WA 99164-6430

and

Sabine M. Huhndorf
The New York Botanical Garden
Bronx, NY 10458

ABSTRACT

Four species of *Valsaria* are recognized: *Valsaria bambusae*, *V. fulvopruinata*, *V. insitiva*, and *V. rubricosa*. Cultures and anamorph of *V. bambusae* are newly described herein. An annotated list is provided for epithets associated with *Valsaria* and its synonyms --- including *Myrmaecium*, *Phaeocreopsis*, and *Hypoxylonopsis* --- and *Valsonectria*. *Endoxylina* and *Pseudothyridaria* are resurrected to accommodate some segregates of *Valsaria*. A more complete list of synonyms for *Pseudovalsaria ferruginea* is provided. Three segregates of *Valsaria* are combined with *Roussoella*. Eight species of *Roussoella* are accepted, including two new species, *R. alveolata* and *R. intermedia*, and three new combinations, *R. chilensis*, *R. donacicola*, and *R. pustulans*. Keys to the genera discussed and to taxa of *Valsaria* and *Roussoella* are provided.

Key words: *Endoxylina*, *Hypoxylonopsis*, *Myrmaecium*, *Phaeocreopsis*, *Pseudothyridaria*, *Pseudovalsaria*, *Roussoella*, *Valsaria*, *Valsonectria*.

The taxonomic position of *Valsaria* Ces. & De Not. has been controversial partially owing to its heterogeneity. Originally, *Valsaria* was erected to accommodate ascomycetes with valsoid ascomatal configurations and two-celled, colored ascospores. Later, Saccardo (1882) complicated the matter by expanding the generic concept to include fungi with eutypoid ascomatal configurations. The original definition of *Valsaria* had already embraced a heterogenous assemblage of fungi. Saccardo further blurred the distinctions among *Valsaria* and other fungi that have two-celled, colored ascospores, e.g., *Amphisphaeria* Ces. & De Not. and *Didymosphaeria* Fuckel. The heterogeneity of *Valsaria* led Wehmeyer (1926) to place some species, e.g., *V. moroides* (Cooke & Peck) Sacc. [= *Pseudovalsaria ferruginea* (Nitschke) Rappaz] and *V. allantospora* Ellis & Everh. [=

Endoxylina allantospora (Ellis & Everh.) Shoemaker & Egger], into the Allantosphaeriaceae and some other species, e.g., *V. insitiva* (Tode: Fr.) Ces. & De Not. and *V. exasperans* (W. Gerard) Sacc. [= *V. fulvopruinata* (Berk.) Sacc.], into the Diaporthaceae. Later, ascus features were used to classify fungi into those with unitunicate asci --- the Pyrenomycetes --- and those with bitunicate asci --- the Loculoascomycetes. Although this provided a more natural classification for most other ostiolate fungi, it imposed new problems on *Valsaria*. Members of *Valsaria* as defined herein were considered by Dennis (1960), Kobayashi (1970), Kobayashi and Doi (1969), and Munk (1953, 1957) to be bitunicate fungi, but were believed by Barr (1978, 1990a), Dennis (1978), Glawe (1985), Huhndorf (1992a), Miller (1949), and Müller and von Arx (1962) to be unitunicate. However, most of them have agreed that the hamathecial elements of these fungi are hypha-like, elongate upward toward the ostiole, and have free ends, and that the ascomata have a wall distinct from the surrounding stromatal tissue.

In this study, *Valsaria* is considered to have bitunicate asci, a true ascomatal wall, and paraphysate hamathecial elements. Unfortunately, this combination of characteristics makes it difficult to place the genus into any presently defined higher taxon of either Pyrenomycetes or Loculoascomycetes. On the basis of the asci we are inclined to consider *Valsaria* among the Loculoascomycetes.

Leuchtmann and Müller (1986) reported the life cycle of *Thyridium vestitum* (Fr.: Fr.) Fuckel, the type species of that genus. *Pleurocytospora vestita* Petr. was demonstrated to be its coelomycetous state. In addition, a hyphomycetous synanamorph, which produces yeast-like blastoconidia, was proven. Interestingly, ascospores of *T. vestitum* germinate by either budding off conidia or producing germ hyphae, a phenomenon commonly observed in *Valsaria* (see below). Coincidentally, *Thyridium* Nitschke has suffered the same fate as *Valsaria*, i.e., not being unequivocally assignable to either the Pyrenomycetes or Loculoascomycetes. *Thyridium vestitum* was considered to have bitunicate asci by Dennis (1978) [under *Fenestella* Tul. & C. Tul.], Munk (1957) [under *Fenestella*], and Wehmeyer (1975), but to have unitunicate asci by Barr (1983, 1990a) and Eriksson and Yue (1989). We are not yet in the position to assess the taxonomic placement of this fungus. However, similarities between the synanamorphs of *T. vestitum* and *Valsaria* taxa, respectively, are recognized.

In this study four species are recognized in *Valsaria*. In addition, some genera that have been entangled with *Valsaria* are also discussed.

Endoxylina Romell and *Pseudothyridaria* Petr. are resurrected. A few *Valsaria* names are found to belong to *Pseudovalsaria* Spooner. A more complete list of synonyms is provided for *P. foedans* (P. Karst.) Spooner [= *P. ferruginea* (Nitschke) Rappaz]. *Valsaria chilensis* Speg., *V. donacicola* Speg., and *V. pustulans* (Ellis & Everh.) Sacc. are assigned to *Roussoella* Sacc. *Roussoella* is revised, with eight species accepted.

VALSARIA CES. & DE NOT.

Cesati and De Notaris (1863), in *Valsaria*, listed four names: *Valsaria insitiva*, *V. donacina* (Fr.: Fr.) Ces. & De Not., *V. decorticans* (Fr.: Fr.) Ces. & De Not., and *V. periplocae* (De Not.) Ces. & De Not. Additionally, they also listed five *Sphaeria* names under *Valsaria*; these were somehow not combined with the generic name. Clements and Shear (1931) chose *V. insitiva* as the type species of the genus; this was followed by most mycologists, e.g., Müller and von Arx (1962) and Barr (1978). Curiously, Munk (1953) typified *Valsaria* with *V. foedans* (P. Karst.) Sacc. which was not listed in Cesati and De Notaris (1863). As *V. insitiva* is the type species of the genus, its identity affects the generic concept. Cesati and De Notaris (1863) cited *Diatrype insitiva* (Tode: Fr.) Fr. as well as *Sphaeria insitiva* Tode: Fr. under *V. insitiva*. Although the authority of *Sphaeria insitiva* has since been considered to be Tode, the modern definition of the name was, in fact, given by De Notaris (1853). According to Hawksworth (1974), the Tode herbarium has been destroyed. Regrettably, we can only conjecture about Tode's fungus from the original description and illustrations (Tode, 1791). It appears to us that Tode's *Sphaeria insitiva* is not the same as De Notaris'. Tode's fungus was said to have widely-effused stromata with a white surface and an eutypoid ascomatal configuration. Although Saccardo (1882) believed Tode's *Sphaeria insitiva* to be *Cryptovalsa ampelina* (Nitschke) Fuckel, the real identity of Tode's fungus is unknown. If we accept Tode's concept of *Sphaeria insitiva*, the application of *Valsaria* will be uncertain. One potential solution is to consider De Notaris as publishing a later homonym, *Sphaeria insitiva* "De Not.", on which the combination *Valsaria insitiva* was based. In doing so, although making *Valsaria insitiva* an illegitimate name, we can stabilize the use of the genus name. *Valsaria robiniae* (Schwein.: Fr.) Cooke could then be used as a substitute for *V. insitiva* "(De Not.) Ces. & De Not." Another potential solution to avoid losing the use of *Valsaria* might involve selecting one of the three other *Valsaria* names listed by Cesati and De Notaris (1863) as the type. *Valsaria decorticans* is unfortunately a synonym of *Valsa ceratosperma* (Tode: Fr.) Maire. Under *V. decorticans*, Cesati and De Notaris (1863) cited Rabenhorst's *Fungi Europaei* no. 146. The exsiccatum at RO [SWITZERLAND: Geneva, Duby, as *Valsa decorticans* Fr.] with the signature of De Notaris is a *Diaporthe* Nitschke. *Valsaria donacina* is a *nomen dubium* (see the list of names herein). There is no material of *V. periplocae* at RO. The De Notaris original pencil sketch preserved at RO leaves no doubt that *V. periplocae* is a synonym of *V. insitiva*. Selecting *V. periplocae* as the type does not make more sense than considering that De Notaris himself published *Sphaeria insitiva*. These two potential solutions can only stabilize the use of the generic name, *Valsaria*, but not the species epithet, *insitiva*.

The solution that we propose herein is also propounded to save *insitiva* as an epithet. The fungus bearing this epithet is widespread, probably cosmopolitan, and has a wide host and substrate range. If one considers De Notaris himself as publishing *S. insitiva* rather than redescribing Tode's *S. insitiva*, *Sphaeria robiniae* will predate *S. insitiva* "De Not." To lose *insitiva* to *robiniae* --- a forgotten name that implies host specificity toward *Robinia* L. --- seems counterproductive, especially because changes in the

Code of Botanical Nomenclature are now aimed to minimize the displacement of well-established names for purely nomenclatural reasons (Hawksworth, 1993). Our solution is, as follows. Material of *Sphaeria insitiva* Tode --- type material --- is unavailable and presumed destroyed. Tode's description and illustrations (1791) are possibly of another fungus, but, because ascospores and other critical structures are not described, we cannot be entirely certain. The host for Tode's collection (1791) is *Vitis* L. De Notaris (1853) accepted *Sphaeria insitiva* based on Tode's description and illustrations (1791) and the descriptions of others. He apparently did not see Tode's material, but described and illustrated material from *Vitis*. His description encompasses a considerable amount of variation in the fungus and established the modern concept of the species which later became accepted as the type species for *Valsaria* Ces. & De Not. (Clements and Shear, 1931). His drawings further reinforce his description. We thus propose that one of the De Notaris' original specimens from RO be designated as interpretive type or the epitype [see Greuter et al. (1994) and Hawksworth (1993) for definition] for *Sphaeria insitiva*, the basionym of *Valsaria insitiva* (Tode: Fr.) Ces. & De Not., because of the inadequacy of Tode's holotype illustrations and description (Tode, 1791). There are four packets at RO labeled as *Sphaeria insitiva* Tode by De Notaris. One packet, collected in 1839, contains material of a *Valsa* Fr. Two packets, both collected in 1842, contain only immature material of *V. insitiva*. The fourth packet [ITALY: 1837, vines of *Vitis*] contains adequate material of *V. insitiva*. It is herein designated as the epitype.

Myrmaecium Nitschke ex Fuckel was first validly published by Fuckel (1869-70) who listed two species: *M. rubricosum* (Fr.: Fr.) Fuckel and *M. durissimum* Fuckel. Both names are synonyms of *Valsaria rubricosa* (Fr.: Fr.) Sacc. It remains unclear to us as to why Clements and Shear (1931) cited "*M. insitiva* (Fr.) Fkl." as the type. In fact, Fuckel (1869-70) did not formally mention *Valsaria insitiva*; neither did he ever combine this species with *Myrmaecium*. The combination *Myrmaecium insitivum* was made by Lindau (1897). In 1880, Saccardo (see Saccardo, 1882) published a later homonym of *Myrmaecium* Nitschke ex Fuckel for some fungi with hyaline ascospores. *Myrmaeciella* Lindau was later used by Lindau (1897) to be a nomenclatural substitute for Saccardo's *Myrmaecium*. Müller and von Arx (1962, 1973) considered *Myrmaeciella* to be a synonym of *Hypocreopsis* P. Karst., as did Rogerson (1970). According to G. J. Samuels (pers. comm.), *Myrmaeciella endoleuca* (Sacc.) Lindau, the type species of that genus, is very unlikely to be a hypocrealean fungus and thus *Myrmaeciella* is not considered to be a synonym of *Hypocreopsis*.

The Kobayasi and Doi (1969) description of *Phaeocreopsis hypoxyloides* Speg., the type species of *Phaeocreopsis* Speg., is in full accordance with *Valsaria rubricosa*. They compared their Japanese specimens with the Spegazzini type from LPS.

Saccardo (1926) treated *Hypoxylonopsis* Henn. as a synonym of *Valsaria*. The type species of *Hypoxylonopsis*, *H. hurae* Henn., was considered to be a synonym of *Valsaria hypoxyloides* Rehm [= *V.*

rubricosa] by Müller and von Arx (1962). Our observation on the type of *H. hurae* at HBG reaffirms the synonymy.

Valsonectria Speg., typified by *V. pulchella* Speg., has been used to harbor some *Valsaria* names. *Valsaria hypoxylodes* Rehm and *Melogramma cinnamomi* Ces., both synonyms of *Valsaria rubricosa*, were, respectively, placed in *Valsonectria* by Barr (1990a) and by Huhndorf (1992a). However, Lindau (1897), Petrak and Sydow (1936), Müller and von Arx (1962), and Rogerson (1970) considered the type species of the genus, *V. pulchella* Speg., to be a hypocrealean fungus. G. J. Samuels (pers. comm.) studied *V. pulchella* and also considered it to be hypocrealean.

We accept four species in the genus herein: *Valsaria bambusae* Kapoor & Gill, *V. fulvopruinata* (Berk.) Sacc., *V. insitiva*, and *V. rubricosa*.

Valsaria sphaerophora (Ellis & Everh.) Barr, growing on *Agave* from Mexico and known only from the type specimen, is a probable member of the genus. It has functionally bitunicate asci and a probably paraphysate hamathecium.

We prefer not to make any formal taxonomic decision about the fungus until more specimens and, hopefully, cultures are available for study.

While morphological features of *Valsaria* tend to be fairly constant, their hosts are quite variable in three of the four species. This partially accounts for the numerous names that have been erected for *V. insitiva* and *V. rubricosa*. *Valsaria insitiva* and *V. rubricosa* have world-wide distribution, whereas *V. fulvopruinata* is known only in North America and Europe and may eventually be proven to be restricted in northern temperate regions. *Valsaria bambusae*, on the other hand, is known as a bamboo-inhabiting fungus only from India thus far.

Species of *Valsaria* are capable of producing two synanamorphs: one is coelomycetous and the other is hyphomycetous. The coelomycetous synanamorph of *V. insitiva* was ascribed to *Cytosporella* Sacc. by Wehmeyer (1923) and Glawe (1985). The hyphomycetous synanamorph was first described in *V. insitiva* by Glawe (1985) who referred to it as *Exophiala*-like. It was subsequently referred to as *Hyphozyma*-like by De Hoog and McGinnis (1987), and it was suggested to us that it was *Hormonema*-like by W. A. Untereiner (pers. comm.). Taxa of *Hormonema* Lagerberg & Melin have been connected with coelomycetous synanamorphs, whereas taxa of *Exophiala* J. W. Carmichael and *Hyphozyma* De Hoog & M. T. Sm. have only been connected to hyphomycetous synanamorphs (see De Hoog and McGinnis, 1987). On account of *Valsaria* taxa being capable of producing coelomycetous synanamorphs, it is more reasonable to refer their hyphomycetous synanamorphs to *Hormonema*. It is noteworthy that ascomycetes with connections with black yeasts are predominantly loculoascomycetous. This again reinforces our view of *Valsaria* being loculoascomycetous.

Valsaria Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 205. 1863.

Lectotype [selected by Clements and Shear (1931)]: *V. insitiva* (Tode:

Fr.) Ces. & De Not.

= *Myrmaecium* Nitschke ex Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 227. 1869-70; *non* Sacc., 1880.

Lectotype [selected here]: *M. rubricosum* (Fr.: Fr.) Fuckel [= *V. rubricosa* (Fr.: Fr.) Sacc.]

= *Phaeocreopsis* Sacc. & Syd. *apud* Lindau in Engl. & Prant., Nat. Pflanzenfam. Nachtr., p. 541. 1900.

Type: *P. hypoxylodes* (Speg.) Sacc. & Syd. [= *V. rubricosa* (Fr.: Fr.) Sacc.]

= *Hypoxylonopsis* Henn., Hedwigia 43: 256. 1904.

Type: *H. hurae* Henn. [= *V. rubricosa* (Fr.: Fr.) Sacc.]

Stromata erumpent from bark tissue, partially immersed and pustular or largely exposed and discoid; surface dull yellowish brown, dull ochraceous brown, dull reddish brown, or dark brown, rugose to rugulose, pruinose or not, split into stellate pattern in some species due to ostiolar protrusion and ascomatal expansion; tissue immediately beneath surface with the same color as the surface, waxy or non-waxy, with or without KOH-extractable pigments; tissue beneath gray to grayish brown, soft, composed entirely of pseudoparenchymatous fungal tissue. Ascomata small, spherical to ovate, usually monostichous, ultimately shrunken and detached from the surrounding stromatal tissue when dry, in valsoid to diatrypoid configurations.

Ostioles slightly projecting above stromatal surface, black, smooth. Asci with eight ascospores arranged in uniseriate manner, cylindrical, short-stipitate, persistent, with apical apparatus faintly visible by light microscopy but, in some species, dome-shaped and fluorescing in the fluorescence brightener, Calcofluor (see Rogers, 1975 for procedure). Ascospores light brown, brown to dark brown, two-celled, ellipsoid, with narrowly to broadly rounded ends, constricted or unconstricted at septum, with fine reticulation, or with coarse reticulation sometimes tending to be longitudinally ribbed on some ascospores. Germination site, appendages, and sheath lacking. Hamathecial elements paraphysate, long, hypha-like, septate, seldom branched, with free ends oriented towards the ostiole.

A general life cycle of *Valsaria* is as follows.

Ascospores germinate by producing yeast-like budding cells or, less frequently, by producing germ tubes. This is followed by the production of hyphae directly from which one-celled, hyaline conidia are produced holoblastically. This stage is *Hormonema*-like. Sometimes, conidiogenous loci proliferate percurrently. Hyphae frequently disarticulate into arthroconidium-like cells. Subsequently, *Cytospora*-like conidiomata are formed in most taxa except for *V. rubricosa*. These conidiomata bear another type of conidium which is one-celled, hyaline, extremely small. These conidia have not been seen to germinate, and may eventually be proven to be spermatia. Conidiogenous cells have minute collarettes and are thickened periclinally, and sometimes are annellated. Teleomorphs are known to be produced only in cultures of *V. rubricosa*.

KEY TO *VALSARIA* SPECIES

1. Stromata with dark brown surface, without KOH-extractable pigments; ascomata with a valsoid configuration.....2

1. Stromata with yellowish brown or reddish brown surface, with vinaceous KOH-extractable pigments; ascomata with either a diatrypoid or valsoid configuration..... 3
2. Ascus apical ring fluorescing in Calcofluor, discoid; ascospores with very faint reticulations, 14-23 x 7-10 μm ; associated with a broad range of hosts, cosmopolitan ***V. insitiva***
2. Ascus apical ring fluorescing in Calcofluor, barrel-shaped; ascospores with coarse ornamentation, ranging from reticulated to longitudinally ribbed, 17-25 x 9-12 μm ; associated only with bamboos, India..... ***V. bambusae***
3. Stromata with dull ochraceous brown to dull yellowish brown surface; ascus apical ring not fluorescing in Calcofluor or, if so, very inconspicuous; ascomata usually with a valsoid configuration; ascospores finely reticulate, 13-20 x 7.5-10 μm ; associated with a broad range of hosts, northern temperate regions..... ***V. fulvopruinata***
3. Stromata with reddish brown surface; ascus apical ring fluorescing in Calcofluor, conspicuous; ascomata usually with a diatrypoid configuration; ascospores finely reticulate, 12-17 x 6-8.5 μm ; associated with a broad range of hosts, cosmopolitan ***V. rubricosa***

Valsaria bambusae Kapoor & Gill, Indian Phytopathol. 14: 152. 1962.

Figs. 10, 16, & 33

Stromata erumpent subepidermally, pulvinate, rounded, 0.5-0.9 mm diam x 0.5-0.6 mm thick, usually confluent into longitudinal stripes; surface dark brown, split in stellate pattern; tissue immediately beneath surface forming a thin crust, ca. 0.1 mm thick, blackish; tissue beneath dull grayish brown, soft. Ascomata ovate, 0.1 mm diam x 0.3-0.4 mm high, in valsoid configuration. Ostioles emerging convergently into black papillae ca. 0.1 mm diam. Asci 140-155 μm in total length x 15-17 μm broad, nearly sessile, with apical apparatus undetected by light microscopy but barrel-shaped when mounted in Calcofluor and examined by fluorescence microscopy. Ascospores light brown to brown, two-celled, ellipsoid, usually with narrowly rounded ends, unstricted at septum, 17-25 x 9-12 μm , coarsely reticulated to longitudinally ribbed. Ascospores germinating by budding off yeast-like conidia or producing germ hyphae.

Colonies on 2% Difco Oatmeal Agar incubated at 20 C under 12 h fluorescent light covering 9 cm Petri dish in 3 wk, appressed, azonate, radially furrowed, with fimbriate margins, white and slimy owing to production of conidia, becoming blackish and less slimy owing to vigorous growth of mycelium. Reverse blackish. Hyphal cells frequently inflated and disarticulating into subglobose, arthroconidium-like cells, 10-22 x 10-16 μm . Conidiomata eventually formed, black, pulvinate, with labyrinthiform locules 70-100 μm broad. Conidia produced blastogenously from germinating ascospores or from vegetative hyphae both on mycelial surface and within conidiomatal locules, hyaline (collectively opalescent), unicellular, smooth,

ellipsoid, sometimes slightly curved, with one end somewhat pointed, 4-6 x 2-2.5 μm , swelling to 8-12 x 4.5-5 μm before budding in multipolar fashion or producing germ hyphae. Other conidiomatal locules producing conidia from phialides in palisades. Phialides cylindrical, hyaline, smooth, 5-10 x 2-2.5 μm . Conidia hyaline (collectively dull orange), unicellular, smooth, ovate, with a truncate base, 2.5-3 x 1.5 μm , not observed to germinate.

SPECIMENS EXAMINED: INDIA: Bombay, Dharwar, 5.1915, Kulkarni, G.S. 26844, culms of *Bambusa* (IMI 180328 [4 microscope slides], ISOTYPE of *Valsaria bambusae*); Assam, Research Center Burnihat, 30.4.1979, Baisya, H.K. 45, culms of bamboo, as *Valsaria bambusae* (IMI 238159); Maharashtra, Dhule Dist., Ranipur, 30.11.1988, Ujjainkar, M.R. & Deoray, S.D., (CULTURED), culms of *Dendrocalamus strictus*, as *Valsaria bambusae* (IMI 333847); 25.10.1974, Panwar, K.S., culms of bamboo, as *Valsaria bambusae* (IMI 189339 & 189341).

NOTES: The ascospore ornamentation was not described in the protologue. Kale (1970) reexamined the type, and reported that the ascospores have longitudinal ribs. In fact, the patterns of ornamentation vary among different ascospores, from reticulate to longitudinally ribbed. A number of ascospores tend to have a reticulate pattern toward the ends and a ribbed pattern toward the septum. *Valsaria bambusae* is closely related to *V. insitiva* with which it shares most characteristics except for having a different ascospore ornamentation and, in average, a larger ascospore size range. It is noteworthy that *V. bambusae* is host-specific --- reported only on bamboo culms.

Valsaria bambusae produces two types of conidia in culture: small phialoconidia in the *Cytosporella*-like synanamorph and large blastoconidia in the *Hormonema*-like synanamorph. The phialoconidia are collectively dull orange and are only found in conidiomatal locules, whereas the blastoconidia are collectively opalescent and can be found both on the surface of mycelia and in conidiomatal locules. The life cycle of *V. bambusae* resembles that of *V. insitiva* except for some conidiomatal locules producing blastoconidia. The conidiomatal locules of *V. insitiva* produce only phialoconidia.

Valsaria fulvopruinata (Berk.) Sacc., Syll. Fung. I, p. 747. 1882.

Figs. 2, 3, 7, 8, 15, & 34

≡ *Sphaeria fulvopruinata* Berk., London J. Bot. (Hooker) 4: 312. 1845.

≡ *Valsa fulvopruinata* (Berk.) Cooke, Proc. Acad. Nat. Sci. Philadelphia 29: 122. 1877.

≡ *Diaporthe fulvopruinata* (Berk.) Sacc., Syll. Fung. I, p. 621. 1882.

≡ *Pseudovalsa fulvopruinata* (Berk.) Cooke, Grevillea 14: 55. 1885.

≡ *Sphaeria obesa* Berk. & M. A. Curtis *apud* Ravenel, Fungi Caroliniani Exsiccati, fasc. IV, no. 47. 1855.

= *Sphaeria decorticans* Kunze ex Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 205. 1863; *non* Fr. [: Fr.], 1817; [*nom. rejic.*, ICBN Art. 64.1].

≡ *Valsaria decorticans* (Kunze ex Ces. & De Not.) Bagl., Ces., & De Not., Erbario Crittogamico Italiano, ser. I, fasc. 26, no. 1280. 1865; *non* (Fr.: Fr.) Ces. & De Not., 1863; [*nom. rejic.*, ICBN Arts. 13.1(d) & 64.1].

- ≡ *Valsaria kunzeana* De Not., Comment. Soc. Crittog. Ital. 2: 482. 1867.
- ≡ *Pseudovalsa kunzeana* (De Not.) Cooke, Grevillea 14: 55. 1885; as "*kunzeiana*".
- = *Diatrype exasperans* W. Gerard, Bull. Torrey Bot. Club 5: 40. 1874.
- ≡ *Valsaria exasperans* (W. Gerard) Sacc., Syll. Fung. II, p. LV. 1883.
- = *Diatrype quadrata* Schwein. ex Berk., Grevillea 4: 94. 1876.
- ≡ *Myrmaecium quadratum* (Schwein. ex Berk.) Rehm, Ascomyc. no. 325. 1876.
- ≡ *Valsaria quadrata* (Schwein. ex Berk.) Sacc., Syll. Fung. I, p. 745. 1882.
- = *Valsaria exasperans* (W. Gerard) Sacc. var. *aceris* Rehm, Ann. Mycol. 10: 355. 1912.

The teleomorph is very similar to that of *V. rubricosa* except for having a dull ochraceous brown to dull yellowish brown surface, having a stellate pattern surrounding ostioles, and usually having a valsoid ascomatal configuration. Ascospores germinating by producing yeast-like conidia or germ hyphae.

Colonies on 2% Difco Oatmeal Agar incubated at 20 C under 12 h fluorescent light covering 9 cm Petri dish in 1.5 wk, appressed, azonate, with diffuse margins, white and slimy owing to production of conidia, becoming ochraceous and less slimy owing to vigorous growth of mycelium. Reverse uncolored. Conidiomata eventually formed, ochraceous first, becoming overlain with brown vinaceous hyphae, pulvinate, surrounded by ochraceous, erect subcylindrical hyphae, with labyrinthiform locules 60-90 µm broad. Hyphal cells frequently inflated and disarticulating into bacilliform to subglobose, arthroconidium-like cells, 6-20 x 6-9 µm. Conidia produced blastogenously from germinating ascospores or from vegetative hyphae on mycelial surface, hyaline (collectively light ochraceous), unicellular, smooth, ellipsoid, 3.5-5 x 2-2.5 µm, swelling to 8-10 x 3-5 µm before budding in multipolar fashion or producing germ hyphae. Conidiomatal locules producing conidia from phialides in palisades. Phialides cylindrical, hyaline, smooth, 8-14 x 2-2.5 µm. Conidia hyaline (collectively pale orange), unicellular, smooth, ovate, with a truncate base, 2.5-3.5 x 1.5 µm, not observed to germinate.

SPECIMENS EXAMINED: CANADA: Ontario, London, 4.1912, Dearness, J., Rehm: Ascomycetes 1992, bark of *Acer nigrum* (S, HOLOTYPE of *Valsaria exasperans* var. *aceris*); Ontario, London, 5.1912, Dearness, J., Sydow: Fung. Exot. Exs. 77, bark of *Acer saccharum*, as *Valsaria exasperans* var. *aceris* (FH; NY; S); Ontario, London, 5.1912, Dearness, J., Fung. Columb. 3900, bark of *Quercus rubra*, as *Valsaria exasperans* (NY [3 pks.]; WSP 13215); Ontario, London, 4-5.1912, Dearness, J., Fung. Columb. 4798, bark of *Acer nigrum*, as *Valsaria exasperans* var. *aceris* (NY [3 pks.]; WSP 13210); Ontario, Muskoka Dist., University of Toronto Forest, 14.9.1963, Cain, R.F., bark of *Acer saccharum*, as *Valsaria insitiva* (WSP 57036, ex TRTC 42645); Ontario, T.F.R., L. Temagami, 12.8.1931, Thompson, G.E. 2581, bark of *Populus tremuloides*, as *Valsaria exasperans* (FH; NY); Ontario, York Co., Nashville, 17.4.1954, Cain, R.F.,

bark of *Fagus grandifolia*, as *Valsaria exasperans* (NY; WSP 30222, ex TRTC 30222); Ontario, York Co., Nashville, 10.11.1956, Cain, R.F., bark of *Fagus*, as *Valsaria exasperans* (FH; NY; WSP 45605, ex TRTC 32455); Ontario, Kenora, Vermilion Bay, Cedar Lake, 30.5.1956, Cain, R.F., bark of *Populus tremuloides*, as *Valsaria exasperans* (NY, ex TRTC 33848). CZECHOSLOVAKIA: Moravia, 9.1911, Petrak, F., large branches of *Fagus*, as *Valsaria rubricosa* (WSP 55066); Mähren, 9.1925, Petrak, F., Mycoth. Gen. 1887, wood, as *Valsaria rubricosa* (WSP 19264). U.S.A.: Alabama, 5.1854, Peters 713, corticated wood of *Juglandis*, as *Sphaeria obesa* (NY); Connecticut, Cobalt, 16.1.1935, Evo, H.G. 69861, bark of *Quercus borealis*, as *Valsaria insitiva* (WSP 41185, ex BPI); Indiana, Putnam Co., Bainbridge, 17.10.1941, Simmons, E.G. 1135, bark of *Populus*, as *Valsaria exasperans* (NY); Indiana, Montgomery Co., Crawfordsville, Kaylors Woods, 13.4.1946, Simmons, E.G. 1250, bark of *Fagus*, as *Valsaria exasperans* (NY); Indiana, Putnam Co., Greencastle, 12.1891, Underwood, L.M., bark, as *Valsaria quadrata* (NY [2 pks.]); Louisiana, St. Martinville, 16.2.1888, Langlois, A.B., Flora Ludoviciana 1843, bark of *Magnolia*, as *Valsaria quadrata* (FH); Maryland, Takoma Park, 21.12.1902, Shear, C.L., twigs of *Robinia pseudoacacia*, as *Valsaria insitiva* (WSP 32315, ex BPI); Massachusetts, Dedham, 29.10.1933, Darker, G.D. 4955, branches of *Quercus*, as *Valsaria exasperans* (FH); Massachusetts, Dedham, 6.11.1897, ex Herb. John G. Hall, dead bark, as *Valsaria exasperans* (FH); Massachusetts, Barre, 12.1912, Murdoch, J., bark of *Quercus*, as *Valsaria* sp. (FH); Massachusetts, Cambridge, Fresh Pond, 14.10.1925, Wehmeyer, L.E. & Linder, D.H. 1287, bark of *Quercus rubra*, as *Valsaria exasperans* (FH); Massachusetts, Conway, Baptist Hill, 5.12.1982, Barr, M.E. 6905 (CULTURED), bark of *Fagus grandifolia*, as *Valsaria exasperans* (NY); Michigan, Lowell, 30.9.1934, Wehmeyer, L.E. 3158, bark of *Quercus*, as *Valsaria exasperans* (NY); Missouri, Pickering, 13.6.1927, Bartholomew, E. 9746, bark of *Acer saccharinum*, as *Valsaria exasperans* (FH); New Hampshire, Waterville, 17.8.1937, Hansbrough, J.R. 82011, bark of *Fagus grandifolia*, as *Valsaria exasperans* (WSP 41195); New Jersey, Newfield, 11.1873, Ellis, J.B., Fung. Columb. 323, bark of *Magnolia glauca*, as *Valsaria exasperans* (NY [2 pks.]; WSP 13212); New Jersey, Newfield, 21.11.1893, Ellis, J.B., bark of *Acer rubrum*, as *Valsaria exasperans* (NY); New Jersey, Newfield, 14.12.1894, Ellis, J.B., bark of cedar, as *Valsaria exasperans* (NY); New York, Alcove, 3.1893, Shear, C.L., N.Y. Fung. 179, bark of *Juglandis cinerea*, as *Valsaria exasperans* (FH; NY [3 pks.]; WSP 43133); New York, Alcove, 18.10.1893, Shear, C.L. 200, bark of *Populus*, as *Valsaria exasperans* (NY); New York, Jamesville, 11.1890, Cook, O.F., bark of *Prunus ilicifolia*, as *Valsaria exasperans* (NY); New York, South Butler, 12.1887, Cook, O.F. 375, bark of *Carpinus*, as *Valsaria exasperans* (NY); North Carolina, West Raleigh, 4.1907, Stevens, F.L., bark of *Quercus*, as *Valsaria exasperans* (FH); Ohio, Lea, T.G. 126, bark of *Platanus occidentalis* (K, HOLOTYPE of *Sphaeria fulvopruinata*); Ohio, Kent, 3.1910, Whetzel & Rankin 5190, dead apple bark, as *Valsaria exasperans* (FH); Oregon, Alsea, 6.1933, Zeller, S.M., dead wood, as *Valsaria*

exasperans (NY); Pennsylvania, Michener 2071 [= 4351], corticated branches of *Acer rubrum*, as *Sphaeria obesa* (FH, ISOSYNTYPE of *Diatrype quadrata*); Pennsylvania, Michener 1378, trunks of *Quercus*, as *Sphaeria obesa* (FH); Pennsylvania, State College, 22.11.1915, Overholts, L.O. 2651, *Quercus*, as *Valsaria exasperans* (NY); South Carolina, Santee Canal, Ravenel, H.W. 1559, corticated wood of *Acer*, as *Sphaeria obesa* (FH, ISOSYNTYPE of *Diatrype quadrata*); South Carolina, Santee Canal, 1848, Ravenel, H.W. 635 [= 1917], corticated wood of *Prunus*, as *Sphaeria obesa* (FH, ISOSYNTYPE of *Diatrype quadrata*); South Carolina, Ravenel, H.W., Fung. Carol. Exs. Fasc. IV, no. 47, bark of *Acer* (FH, TYPE of *Diatrype obesa*); West Virginia, Fayette Co., Nuttall, L.W., bark, as *Valsaria exasperans* (FH [3 pks]; NY [2 pks.]); Wisconsin, Dane Co., Madison, 11.5.1951, Greene, H.C. 1525, bark of *Alnus vulgaris*, as *Valsaria insitiva* (WSP 31739); Wisconsin, Cane Co., Madison, 17.4.1952, Greene, H.C. 1601, bark of *Quercus*, as *Valsaria insitiva* (WSP 35196). LOCALITY UNKNOWN: 1844, Kunze, bark of *Fagus* (RO, HOLOTYPE of *Sphaeria decorticans*).

NOTES: Wehmeyer (1923) [as *V. exasperans*] cultured this fungus on Leonian's agar and reported the conidiomatal locules as labyrinthiform. He referred this conidial state to *Cytospora* Sacc. Recently, we obtained cultures of *V. fulvopruinata* from a 12-year-old specimen, Barr no. 6905, and reaffirmed Wehmeyer's observation. Furthermore, Wehmeyer (1923) noted that hyphae "broke up into an oidia-like formation". Thus, apparently he observed hyphal disarticulation to form arthroconidium-like cells. However, he did not observe the *Hormonema*-like synanamorph.

Valsaria fulvopruinata and *V. rubricosa* are more closely related to each other than to either *V. insitiva* or *V. bambusae*. *Valsaria fulvopruinata* and *V. rubricosa* are similar in having more colorful stromatal surfaces, in having vinaceous KOH-extractable pigments, and in having fine conspicuous reticulation on ascospores. They differ mainly in stromatal surface colors and in the large fluorescing ascal apical ring of the latter species. Furthermore, *Valsaria fulvopruinata* usually produces a valsoid ascomatal configuration and a stellate pattern on the stromatal surface. *Valsaria fulvopruinata* is commonly found in eastern North America. We have seen only two specimens outside this region: one from Oregon, U.S.A. and one from Czechoslovakia. A specimen from Puerto Rico [Yanko, 10.2.1915, Fink, B., Petrak's Mycotheca Generalis 100, dead bark, as *Valsaria hypoxylodes* (NY)] is likely to be the present fungus. However, its immature status does not allow us to make a positive identification.

The type material of *Sphaeria fulvopruinata* at the Berkeley herbarium (K) is immature. However, Berkeley's pencil drawing of asci and ascospores on the paper card of the specimen is characteristic for this fungus and proves that he must have seen the teleomorphic structures. Currey (1858) had also observed and depicted the asci and ascospores. His measurement for the ascospores is 0.0006-0.0007 inch (ca. 15-18 μ m) long. It is also noteworthy that this specimen had had two pieces of material. A spot with a mixture of dried glue and wood tissue on the paper card indicates that a piece was removed. It is probable that the removed piece contained mature

teleomorphic structures from which Berkeley made the drawing. *Valsaria exasperans* is a better known name for this fungus; unfortunately, its basionym was preceded by *S. fulvopruinata*. Moreover, the type material of *V. exasperans* was not located. *Sphaeria decorticans* Kunze ex Ces. & De Not., based on a specimen of Kunze, was published by Cesati and De Notaris (1863) with a brief diagnosis. Although the name was listed by them under *Valsaria*, it was not combined with the genus until *Erbario Crittogamico Italiano*. No. 1280 of the exsiccata has "*Valsaria decorticans*" on the label. However, material in no. 1280 at RO is *V. rubricosa* which had been examined by Traverso and led him (Traverso, 1906) to synonymize *Sphaeria decorticans* with *V. rubricosa*.

Valsaria insitiva (Tode: Fr.) Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 205. 1863. Figs. 1, 9, 11, 12, & 13

= *Sphaeria insitiva* Tode, Fung. Mecklenb. Sel. II, p. 36. 1791; Tode: Fr., Syst. Mycol. II, p. 366. 1823; Tode: Fr. *sensu* De Not., Mem. R. Accad. Sci. Torino, ser. II, 13: 13. 1853.

= *Myrmaecium insitivum* (Tode: Fr.) Lindau *apud* Engl. & Prantl, Nat. Pflanzenfam. I, p. 478. 1897.

= *Sphaeria robiniae* Schwein., Schriften Naturf. Ges. Leipzig 1: 33. 1822; Schwein.: Fr., Syst. Mycol. II, p. 352. 1823.

= *Valsaria robiniae* (Schwein.: Fr.) Cooke, Grevillea 13: 37. 1884.

= *Sphaeria phlyctaenodes* Mont. *apud* Durieu, Fl. Algér. Crypt. I, p. 468. 1846.

= *Valsa phlyctaenodes* (Mont.) Mont., Syll. Gen. Sp. Crypt., p. 219. 1856.

= *Valsaria phlyctaenodes* (Mont.) Sacc., Syll. Fung. I, p. 747. 1882.

= *Pseudovalsa phlyctaenodes* (Berk.) Cooke, Grevillea 14: 55. 1885.

= *Sphaeria notarisii* Mont. *apud* Durieu, Fl. Algér. Crypt. I, p. 470. 1846.

= *Valsa notarisii* (Mont.) Mont., Syll. Gen. Sp. Crypt., p. 218. 1856.

= *Valsaria notarisii* (Mont.) Sacc., Syll. Fung. I, p. 742. 1882.

= *Pseudovalsa notarisii* (Berk.) Cooke, Grevillea 14: 55. 1885.

= *Sphaeria periplocae* De Not., Microm. Ital. Dec. VIII, no. 2. 1851.

= *Valsaria periplocae* (De Not.) Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 205. 1863.

= *Sphaeria cincta* Curr., Trans. Linn. Soc. London 22: 277. 1858.

= *Diatrype cincta* (Curr.) Berk. & Broome, Ann. Mag. Nat. Hist., ser. III, 3: no. 846. 1859.

= *Valsaria cincta* (Curr.) Sacc., Syll. Fung. I, p. 742. 1882.

= *Myrmaecium cinctum* (Curr.) Lindau *apud* Engl. & Prantl, Nat. Pflanzenfam. I, p. 480. 1897.

? = *Valsaria syconophila* Schulzer, Verh. K. K. Zool.-Bot. Ges. Wien 20: 652. 1870.

= *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. gleditschiae-triacanthi* Sacc., Mycotheca Veneta no. 238. 1875.

= *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. ulmi-campestris* Sacc., Mycotheca Veneta no. 239. 1875.

- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. paliuri-aculeati* Sacc., Mycotheca Veneta no. 240. 1875.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. quercus-pedunculatae* Sacc., Mycotheca Veneta no. 241. 1875.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. mori-albae* Sacc., Mycotheca Veneta no. 242. 1875.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. robiniae-pseudacaciae* Sacc., Mycotheca Veneta no. 243. 1875.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. fraxini-orni* Sacc., Mycotheca Veneta no. 244. 1875.
- = *Diatrype viticola* Schwein. ex Berk., Grevillea 4: 96. 1876; non *Sphaeria viticola* Schwein.
 - ≡ *Valsaria viticola* (Schwein. ex Berk.) Sacc., Syll. Fung. I, p. 743. 1882.
- = *Valsa celtidis* Cooke, Grevillea 5: 55. 1876.
 - ≡ *Valsaria celtidis* (Cooke) Sacc., Syll. Fung. I, p. 742. 1882.
 - ≡ *Pseudovalsa celtidis* (Cooke) Cooke, Grevillea 14: 55. 1885.
- = *Valsa clethraecola* Cooke & Ellis, Grevillea 5: 92. 1877.
 - ≡ *Valsaria clethraecola* (Cooke & Ellis) Sacc., Syll. Fung. I, p. 748. 1882.
 - ≡ *Pseudovalsa clethraecola* (Cooke & Ellis) Cooke, Grevillea 14: 55. 1885; as "*clethricola*".
- = *Diatrype aethiops* Cooke & Ellis, Grevillea 6: 10. 1877.
 - ≡ *Valsaria aethiops* (Cooke & Ellis) Sacc., Syll. Fung. I, p. 745. 1882.
- = *Valsa nigrofacta* Cooke & Ellis, Grevillea 6: 12. 1877.
 - ≡ *Valsaria nigrofacta* (Cooke & Ellis) Sacc., Syll. Fung. I, p. 748. 1882; as "*nigrifacta*".
 - ≡ *Pseudovalsa nigrofacta* (Cooke & Ellis) Cooke, Grevillea 14: 55. 1885; as "*nigrifacta*".
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. carpini-betuli* Sacc., Mycotheca Veneta no. 1185. 1878.
- = *Valsaria farlowiana* Sacc., Michelia 2: 137. 1880.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. celtidis* Sacc., Mycotheca Veneta no. 1495. 1881.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. deminuta-negundinis* Sacc., Mycotheca Veneta no. 1496. 1881.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. wistariae* Sacc., Mycotheca Veneta no. 1497. 1881.
- = *Valsaria atrata* Sacc. & Briard, Atti Ist. Ven. Sci. Venezia 6: 22. 1884.
- = *Dothidea rudis* P. Karst. & Har., J. Bot. (Morot) 3: 206. 1889.
 - ≡ *Valsaria rudis* (P. Karst. & Har.) Theiss. & Syd., Ann. Mycol. 12: 273. 1914.
- = *Valsaria xanthoxyli* Ellis & Everh., Bull. Torrey Bot. Club 24: 280. 1897.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. gleditschiae* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 276. 1898.
- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. parkinsoniae* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 276. 1898.

- = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. polygoni* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 276. 1898.
 = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. rauwolfiae* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 276. 1898.
 ? = *Valsaria mata* Rolland, Bull. Soc. Mycol. France 21: 24. 1905.
 ? = *Valsaria spartii* Maubl., Bull. Soc. Mycol. France 21: 88. 1905.
 = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. acaciae-caveniae* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 19: 373. 1909.
 = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. cordiae-gerascanthi* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 19: 373. 1909.
 = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *f. mimosae-polycarpae* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 19: 373. 1909.
 = *Valsaria consors* Rehm, Philipp. J. Sci. 8: 259. 1913.
 = *Valsaria citri* Rehm, Leaf. Philipp. Bot. 6: 2270. 1914.
 = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *var. coluteae* Sacc., Ann. Mycol. 12: 298. 1914.
 = *Valsaria insitiva* (Tode: Fr.) Ces. & De Not. *var. linderiae* Sacc., Ann. Mycol. 12: 298. 1914.
 = *Valsaria eucalypti* (Kalchbr. & Cooke) Sacc. *f. lusitanica* Gonz. Frag., Bot. Soc. Broter. 2: 19. 1924.
 = *Valsaria batesii* Doidge, Bothalia 4: 866. 1948.
 = *Valsaria indica* Kale, Sydowia 23: 194. 1969.
 = *Valsaria cryptomeriae* Kar & Maity, Trans. Brit. Mycol. Soc. 55: 5. 1970.
 = *Sphaeria notarisii* Mont. *var. lanceolata* Mont., *ined.*

The teleomorph and anamorph that we observed are much as described by Glawe (1985).

SPECIMENS EXAMINED: ALGERIA: Bone, Durieu, M., wood (PC, HOLOTYPE of *Sphaeria phlyctaenodes*); Durieu, M., wood (PC, SYNTYPES of *Sphaeria notarisii*); Durieu, M., twigs, as *Sphaeria notarisii* *var. lanceolata* Mont., *ined.* (PC). ARGENTINA: Santa Catalina, 29.8.1891, Spegazzini, C., twigs of *Gleditschia triacanthos* (LPS 6003, HOLOTYPE of *Valsaria insitiva f. gleditschiae*); La Plata, 21.7.1891, Spegazzini, C., twigs of *Parkinsonia aculeata* (LPS 6007, HOLOTYPE of *Valsaria insitiva f. parkinsoniae*); La Plata, 1.5.1902, Spegazzini, C., twigs of *Parkinsonia aculeata*, as *Valsaria insitiva f. parkinsoniae* (LPS 6010); La Plata, 1.3.1892, Spegazzini, C., twigs of *Polygonum* (LPS 6016, HOLOTYPE of *Valsaria insitiva f. polygoni*); La Plata, 6.7.1891, Spegazzini, C., twigs of *Rauwolfia* (LPS 6017, HOLOTYPE of *Valsaria insitiva f. rauwolfiae*); La Plata, 5.1904, Spegazzini, C., twigs of *Acacia cavenia* (LPS, HOLOTYPE of *Valsaria insitiva f. acacia-caveniae*); Santa Catalina, 7.1905, Spegazzini, C., twigs of *Cordia gerascantha* (LPS 6004, HOLOTYPE of *Valsaria insitiva f. cordiae-gerascanthi*); La Plata, 20.6.1905, Spegazzini, C., twigs of *Mimosa polycarpa* (LPS 6011, HOLOTYPE of *Valsaria insitiva f. mimosae-polycarpae*); Huhndorf, S.M. 1089 (CULTURED) & 1091 (CULTURED), wood (JDR). CANADA: Ontario, London, 5.11.1913, Dearness, J. 1617a, wood of *Colutea arborescens* (PAD, HOLOTYPE of *Valsaria insitiva var. coluteae*); Ontario, London, 11.1913, Dearness, J.,

wood of *Lindera benzoin* (PAD, HOLOTYPE of *Valsaria insitiva* var. *linderiae*). FRANCE: Troyes, 27.5.1884, Briard 11, stems of *Brassica oleracea* (PAD, HOLOTYPE of *Valsaria atrata*); no. 24, twigs of *Quercus* (H [herb. Karsten 3713], SYNTYPE of *Dothidea rudis*); Lande, Ecomusée de la Grande, 8.1990, Rogers, J.D., (CULTURED), twigs of *Malus* (JDR); Miramont, près Mirande, 31.3.1951, Moreau, twigs of *Spartium junceum*, as *Valsaria spartii* (PC). GERMANY: Monte Steinberg, spring of 1821, Fuckel, corticated wood of *Quercus*, as *Melogramma rubricosum* (UPS). INDIA: West Bengal, Darjeeling, Victoria falls, 23.7.1966, Kar, A.K. 690, wood of *Cryptomeria japonica* (IMI 137235, ISOTYPE of *Valsaria cryptomeriae*); Kadai Kanai, 10.1964, Tilak, S.T. & Kale, S.B., stems of *Acacia melanoxylon* (IMI 180327 [4 microscope slides], ISOTYPE of *Valsaria indica*). ITALY: 1837, vines of *Vitis*, as *Sphaeria insitiva* Tode by De Notaris (RO, EPITYPE [selected here] of *Sphaeria insitiva*); Genoa, pencil sketching of De Notaris (RO, LECTOYPE [selected here] of *Sphaeria periplociae*); Venetia, Trevis, Selva, 11.1873, Saccardo, P.A., Mycotheca Veneta no. 242, branches of *Morus alba* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *mori-albae*); Venetia, Trevis, Selva, 9.1874, Saccardo, P.A., Mycotheca Veneta no. 243, branches of *Robinia pseudacacia* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *robiniae-pseudacaciae*); Venetia, Trevis, Selva, 9.1874, Saccardo, P.A., Mycotheca Veneta no. 244, branches of *Fraxinus ornus* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *fraxini-orni*); Venetia, Trevis, Selva, 9.1875, Saccardo, P.A., Rabenhorst's Fungi Europaei no. 2111, branches of *Robinia pseudacacia*, as *Valsaria insitiva* f. *robiniae-pseudacaciae* (RO); Venetia, Trevis, Selva, autumn.1876-77, Saccardo, P.A., Mycotheca Veneta no. 1185, branches of *Carpinus betulus* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *carpini-betuli*); Venetia, Trevis, Selva, 4.1874, Saccardo, P.A., Mycotheca Veneta no. 238, branches of *Gleditsia triacanthos* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *gleditschiae-triacanthi*); Venetia, Trevis, Selva, 4.1874, Saccardo, P.A., Mycotheca Veneta no. 239, branches of *Ulmus campestris* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *ulmi-campestris*); Venetia, Trevis, Selva, 10.1873, Saccardo, P.A., Mycotheca Veneta no. 240, branches of *Paliurus aculeatus* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *paliuri-aculeati*); Venetia, Trevis, Selva, 4.1873, Saccardo, P.A., Mycotheca Veneta no. 241, branches of *Quercus pedunculata* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *mori-albae*); Venetia, Trevis, Bosco Montello, Saccardo, P.A., Rabenhorst's Fungi Europaei no. 2112, branches of *Quercus pedunculata*, as *Valsaria insitiva* f. *quercus-pedunculatae* (RO); Padova, 1.1881, Bizzozero, G., Mycotheca Veneta no. 1495, branches of *Celtidis australis* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *celtidis*); Padova, 1.1881, Bizzozero, G., Mycotheca Veneta no. 1496, branches of *Negundinis fraxinifolius* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *deminuta-negundinis*); Padova, 9.1880, Mycotheca Veneta no. 1497, branches of *Wistaria sinensis* (RO [2 pks.], TYPE of *Valsaria insitiva* f. *wistariae*). PHILIPPINES: Los Baños, 21.10.1913, Raimundo, M.B. 1873, decorticated wood of *Citrus nobilis* (S, HOLOTYPE of *Valsaria citri*); Los Baños, 15.12.1912, Baker, C.F. 561a,

dead limbs on ground (S, HOLOTYPE of *Valsaria consors*). PORTUGAL: Taboacao, 11.1922, Pinto, J.M. 607, wood of *Eucalyptus globulus* (MA 5671 [MA-FUNHIST 19882], HOLOTYPE of *Valsaria eucalypti f. lusitanica*). SIERRA LEONE: 29.9.1951, Deighton, F.C., dead twigs of *Duranta repens*, as *Valsaria tax. sp. I* (IMI 48077). SOUTH AFRICA: Salisbury, Bates, G.R., M.R. 6762, twigs of *Cinnamomum camphora* (PREM 35296, HOLOTYPE of *Valsaria batesii*). U.K.: Blackheath Park, 3.1855 & Eltham Grove, 4.1855, branches (K, HOLOTYPE of *Valsa cincta*). U.S.A.: Kansas, Rockport, 11.1894, Bartholomew, E., Fung. Columb. 639, stems of *Amorpha fruticosa*, as *Valsaria insitiva* (WSP 13213); Louisiana, Collinston, 11.4.1932, Shear, C.L., bark of *Gleditsia*, as *Valsaria insitiva* (WSP, ex BPI); Louisiana, St. Martinville, 6.3.1897, Langlois, A.B. 2500, decorticated branches of *Xanthoxylum clavaherculis* (NY, HOLOTYPE of *Valsaria xanthoxyl*); Massachusetts, Cambridge, Farlow, W.G., stems of *Berberis vulgaris* (PAD, HOLOTYPE of *Valsaria farlowiana*); New Jersey, near Malaga, 2.1877, Ellis, J.B. 2495, decorticated twigs of *Morus* (NY, ISOTYPE of *Diatrype aethiops*); New Jersey, Newfield, Ellis, J.B. 2436, stems of *Clethra alnifolia* (K, HOLOTYPE of *Valsa clethraecola*); New Jersey, Newfield, 9.1875, Ellis, J.B. 3358, branches of *Clethra alnifolia*, as *Valsa clethraecola* (NY); New Jersey, Newfield, 9.1877, Ellis, J.B. 2530, corticated wood (NY, ISOTYPE of *Valsa nigrofacta*); New Jersey, Newfield, 2.1878, Ellis, J.B., branches, as *Valsa nigrofacta* (NY); New Jersey, Newfield, 27.12.1877, Ellis, J.B., branches, as *Valsa nigrofacta* (NY); New York, Alcove, 11.1893, Shear, C.L., bark of *Acer saccharum*, as *Valsaria insitiva* (WSP 32323, ex BPI); Pennsylvania, Bethlehem and North Carolina, Salem, Syn. 1233, decorticated wood (PH, HOLOTYPE of *Sphaeria robiniae*); Pennsylvania, Bethlehem, Syn. 1233, Collins Coll. 54, wood, as *Sphaeria robiniae* (PH); South Carolina, Ravenel, H.H. 1833, twigs of *Celtis* (K, HOLOTYPE of *Valsa celtidis*); South Carolina, 4975, stems of *Vitis*, as *Sphaeria viticola* Schwein. (K, HOLOTYPE of *Diatrype viticola*); Virginia, Radnor, 1.1927, Shear, C.L., bark of *Prunus serotina*, as *Valsaria insitiva* (WSP 32346, ex BPI).

NOTES: *Valsaria insitiva* and *V. bambusae* are very closely related. Their differences are discussed in the NOTES on the latter fungus herein.

Berkeley (1876) credited Schweinitz as being the author of *Diatrype viticola* and cited specimen 4975 from South Carolina. Saccardo (1882) combined the epithet with *Valsaria* and cited *Diatrype viticola* "Schwein." as a synonym. Meanwhile, Saccardo (1882) also transferred *Sphaeria viticola* Schwein.: Fr. to *Eutypa* Tul. & C. Tul. and stressed that *Diatrype viticola* is hardly different from *V. insitiva*. We examined both specimen no. 4975 from K, which was labelled as *Sphaeria viticola* Schwein., and Schweinitz's original material of *S. viticola* [U.S.A.: North Carolina, Salem, Syn. 1290, twigs of *Vitis rotundifolia* (HOLOTYPE of *Sphaeria viticola*)] from PH. The former is the same as *V. insitiva*, whereas the latter is the same as *Creosphaeria sassafras* (Schwein.: Fr.) Y.-M. Ju, San Martin, & J. D. Rogers, a xylariaceous fungus. It is not yet known why Saccardo made the combination *Eutypa viticola* (Schwein.: Fr.) Sacc. for *Sphaeria viticola*

Schwein.: Fr. It is certainly possible that there are still some fragments of Schweinitz's original material in some other herbaria that correspond with an *Eutypa*. In any case, we consider Berkeley as publishing a new name, *Diatrype viticola*, and consider specimen no. 4975, which was cited by Berkeley (1876), to be the holotype.

We have not examined the type of *V. tamaricis* Mundkur & Ahmad from India. Probable authentic material from Pakistan [Rahim Yar Khan, 25.8.1964, on *Tamarix articulata* (ZT)] shows that this name may represent a variant of *V. insitiva*. The material has ascospores slightly smaller, 12-14 x 6-7 µm, and more light-colored than *V. insitiva* but is otherwise identical to the latter. Further studies, including culturing, are needed to determine its taxonomic status.

Valsaria rubricosa (Fr.: Fr.) Sacc., Nuovo Giorn. Bot. Ital. 8: 183. 1876.

Figs. 4, 6, & 14

≡ *Sphaeria rubricosa* Fr.: Fr., Elench. Fung. II, p. 63. 1828.

≡ *Hypoxylon rubricosum* (Fr.: Fr.) Fr., Summa Veg. Scand. II, p. 384. 1849.

≡ *Melogramma rubricosum* (Fr.: Fr.) Tul. & C. Tul., Sel. Fung. Carp. II, p. 84. 1863.

≡ *Myrmaecium rubricosum* (Fr.: Fr.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 227. 1869-70.

= *Hypoxylon walterianum* Berk. & Ravenel *apud* Ravenel, Fung. Carol. Exs. Fasc. IV, no. 35. 1855.

= *Myrmaecium durissimum* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 228. 1869-70.

≡ *Valsaria durissima* (Fuckel) Sacc., Syll. Fung. I, p. 748. 1882.

≡ *Pseudovalsa durissima* (Fuckel) Cooke, Grevillea 14: 55. 1885.

? = *Myrmaecium abietinum* Niessl, Hedwigia 13: 42. 1874. *Fide* Saccardo (1882), Traverso (1906), and Müller and von Arx (1962).

= *Hypoxylon gemmatum* Berk. & Ravenel *apud* Berk., Grevillea 4: 50. 1875.

≡ *Sphaeria gemmata* Berk. & Ravenel, *ined.*

≡ *Melogramma gemmata* (Berk. & Ravenel) Cooke, Grevillea 13: 103. 1885.

≡ *Valsaria gemmata* (Berk. & Ravenel) Ellis & Everh., N. Amer. Pyren., p. 562. 1892.

= *Melogramma cinnamomi* Ces., Atti Accad. Sci. Fis. 8: 19. 1879.

≡ *Valsaria cinnamomi* (Ces.) Sacc., Syll. Fung. I, p. 748. 1882.

≡ *Valsonectria cinnamomi* (Ces.) Huhndorf, Mycologia 84: 642. 1992.

= *Melogramma eucalypti* Kalchbr. & Cooke, Grevillea 9: 31. 1880.

≡ *Valsaria eucalypti* (Kalchbr. & Cooke) Sacc., Syll. Fung. I, p. 746. 1882.

= *Valsaria purpurea* Peck, Bull. Torrey Bot. Club 11: 28. 1884.

= *Valsaria hypoxylodes* Ellis & Everh., J. Mycol. 7: 131. 1892; *non* Rehm, 1912.

≡ *Valsonectria hypoxylodes* (Ellis & Everh.) Barr, Mycotaxon 39: 137. 1990.

- = *Valsaria pseudohypoxyylon* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 276. 1898.
- = *Hypocreopsis hypoxyloides* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 291. 1899.
- = *Phaeocreopsis hypoxyloides* (Speg.) Sacc. & Syd., Syll. Fung. XVI, p. 592. 1902.
- = *Myrmaecium hypoxyloides* Rehm, Hedwigia 40: 148. 1901.
- = *Hypoxyylonopsis hurae* Henn., Hedwigia 43: 256. 1904.
- = *Valsaria hurae* (Henn.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Cl., Abt. 1, 119: 924. 1910.
- = *Valsaria hypoxyloides* Rehm *apud* Theiss., Ann. Mycol. 10: 12. 1912; *non* Ellis & Everh., 1892; [*nom. rejic.*, ICBN Art. 64.1].
- = *Valsaria rehmana* S. Teng, Sinensia 4: 391. 1934.
- = *Hypoxyylonopsis rehmana* (S. Teng) S. Teng, Chung-kuo Ti Chen-chun [Fungi of China], p. 761. 1963; as "*Hypoxylopsis*".
- = *Valsonectria reticulata* Loeffler & E. Müller, Ber. Schweiz. Bot. Ges. 71: 413. 1961.
- = *Valsaria mundkurina* Muderji & Kapoor, Česká Mykol. 23: 258. 1969.
- = *Valsaria reticulata* Kar & Maity, Indian Phytopath. 32: 425. 1979.

The teleomorph and anamorph that we observed are much as described by Kobayasi and Doi (1969) [as *Phaeocreopsis hypoxyloides*] and Huhndorf (1992a) [as *Valsonectria cinnamomi*].

SPECIMENS EXAMINED: BRAZIL: Rio Juruá, Bom Fim, 11.1900, Ule, E. 2823, bark of *Hura crepitans* (HBG, LECTOTYPE [selected here] of *Hypoxyylonopsis hurae*); Rio Tijuca, 5.1893, Ule 2070, bark (S [herb. Rehm], HOLOTYPE; S [herb. Sydow], ISOTYPE of *Myrmaecium hypoxyloides*); São Leopoldo, Rio Grande do Sul, Rick, J., Fung. Austro-Amer. 347, bark (NY, ISOTYPE of *Valsaria hypoxyloides* Rehm); Bahia, Mun. Tremedal, 18.7.1991, Vital, D.M. & Buck, W.R. 20342, bark of *Eucalyptus*?, as *Valsonectria cinnamomi* (NY [3 pks.]). CANADA: Ontario, Belleville, 1882, Macoun, J. 32, wood (NYS, HOLOTYPE of *Valsaria purpurea*). DOMINICA: Gombe Forest, 3.6.1961, Welden, A.L. 1947, bark, as *Phaeocreopsis hypoxyloides* (NY). FRANCE: Guepin, corticated wood (L 911, 81-62, LECTOTYPE [selected here] of *Sphaeria rubricosa*); Dareizé, corticated wood of *Populus*, as *Sphaeria rubricosa* (PC [2 pks.]). FRENCH GUIANA: Leprieur 237, wood, as *Hypoxyylon rubricosum* (PC [2 pks.]). GERMANY: Nassau, Oestricher Wald, Fuckel, L., bark of *Alnus glutinosa* (G, HOLOTYPE of *Myrmaecium durissimum*); Nassau, Oestrich, Fuckel, L., Herb. Barbey-Boissier 290, bark of *Alnus glutinosa*, as *Valsaria durissima* (WSP 22113). GUADELOUPE: Vallon Montebello, 2.1987, Vivant, J., bark, as *Phaeocreopsis hypoxyloides* (NY). INDIA: Delhi, University campus, 14.8.1966, Dhawan, S., bark of *Azadirachta indica* (IMI 130294, ISOTYPE of *Valsaria mundkurina*); Jabalpur, 1.12.1982, Rajak, R.C., bark of *Aralia corylifera*, as *Valsaria mundkurina* (IMI 274537); Faizabad, 15.5.1977, Kanaujia, R.S., bark of *Dalbeagia sissoo*, as *Valsaria mundkurina* (IMI 217053); 4.11.1976, Kanaujia, R.S., bark of *Mangifera indica*, as *Valsaria*

mundkurina (IMI 210027); Jodhpur, 4.3.1975, Panwar, K.S., wood, as *Valsaria mundkurina* (IMI 192158); Sangavi, 28.12.1987, Ujjainkar, M.R. 42, twigs of *Mitragyna parvifolia*, as *Valsaria indica* (IMI 328922); West Bengal, Dist. Jalpaigwir, Rajabhalpawa, elev. 3500 ft., 23.9.1974, Gupta, S.K. PCC 428, comm. A.K. Kar via M.E. Barr, fallen log of *Terminalia chebula* (JDR). ITALY: Locarno, Sul Frassino, 1863, Daldini, bark, as *Valsaria kunzeana* (RO); Locarno, Sul Frassino, 1864, Daldini, Erbar. Crittogam. Ital. 1280, bark, as *Valsaria decorticans* (RO [2 pks.]). PANAMA: San Blas, Puerto Obaldia, 23.6.1975, Dumont, K.P. et al. 1106, log, as *Phaeocreopsis hypoxyloides* (NY). PARAGUAY: 3.1891, Morong, T. 1431 (2 pks.), comm. by Eckfeldt, J.W., corticated wood (NY, HOLOTYPE of *Valsaria hypoxyloides* Ellis & Everh.). SOUTH AFRICA: Somerset East, MacOwan, P. 1179, bark of *Eucalyptus globulus* (K, ISOTYPE of *Melogramma eucalypti*). SRI LANKA: Kandy, 1865, Beccari, O. 351, bark of *Cinnamomum* (RO, HOLOTYPE of *Melogramma cinnamomi*); Rilagala-Pass, 1.5.1957, Riggerbach, A., isolated from soil by Stoll, C. on 18.10.1960, as *Valsonectria verrucosa* Loeffler & E. Müller, *ined.* (ZT, HOLOTYPE of *Valsonectria reticulata*). TAIWAN: Taipei City, Hsin-tien, 3.12.1983, Ju, Y.-M. 72031201, bark of *Cinnamomum camphora* (JDR); Tainan Co., Nan-hsi, 24.9.1984, Ju, Y.-M. 73092401 (CULTURED), bark (JDR). U.S.A.: Maryland, Glen Sligo, 26.11.1899, Shear, C.L., Fung. Columb. Continued 1421, bark of *Quercus*, as *Valsaria exasperans* (NY [3 pks.]; WSP 13211); South Carolina, Black Oak, 12.1850, Ravenel, H.W. 1385, decorticated wood, as *Sphaeria gemmata* Berk. & Ravenel, *ined.* (FH, ISOTYPE of *H. gemmatum*); South Carolina, Fung. Carol. Exs. Fasc. IV, 35, bark of *Liquidambar* (FH [2 pks.]; NY, SYNTYPES of *Hypoxylon walterianum*). LOCALITY UNKNOWN: 10.1828, wood of *Quercus*, as *Sphaeria rubricosa* (L 910, 269-451).

NOTES: This fungus has recently been transferred to *Valsonectria* Speg., independently, by Barr (1990a) and by Huhndorf (1992a). They both considered that *V. rubricosa* and *V. insitiva* are not congeneric. When life cycles as well as morphology of both teleomorphs and anamorphs are taken into account, the similarity between these two fungi is far greater than the dissimilarity. Differences exist only in stromatal surface colors, in whether a stellate pattern is present or absent on the stromatal surfaces, in whether or not stromatal pigments are extractable by KOH solution, and in ascomatal configurations. With the existence of *V. fulvopruinata*, the idea of separating *V. rubricosa* and *V. insitiva* into different genera is further challenged. Like *V. rubricosa*, *Valsaria fulvopruinata* has a colorful stromatal surface and stromatal pigments which are extractable by KOH solution. On the other hand, it has, like *V. insitiva*, a stellate pattern on the stromatal surface and a valsoid ascomatal configuration.

Valsaria rubricosa is the only taxon in the genus that is not known to have the *Cytospora* state and that is known to produce teleomorph in culture. Tulasne and Tulasne (1863) described and illustrated a coelomycetous state associated with this fungus from the natural substrate.

The original material of *Sphaeria rubricosa* was not located at PC and UPS but at L. The L material is here designated as the lectotype. The

Hennings type of *Hypoxylonopsis hurae* at B is no longer available. The HBG duplicate is accordingly selected as the lectotype. We did not examine the type of *Valsaria reticulata* Kar & Maity. It was mentioned in the protologue (Kar and Maity, 1979) that part of the type was deposited at IMI. Unfortunately, we were not able to locate it. However, the description and illustrations in Kar and Maity (1979) leave no doubt that *V. reticulata* is a synonym of *V. rubricosa*.

ENDOXYLINA ROMELL

The genus *Endoxylina* embraces some diatrypaceous taxa whose ascospores are septate, and darker and larger than those of other diatrypaceous fungi. *Endoxylina* was reduced to synonymy with *Eutypa* Tul. & C. Tul. by Rappaz (1987). Only two species are dealt with in this work because they have been associated with *Valsaria*. Both of them have two-celled ascospores. Multicelled ascospores can be found in another taxon of *Endoxylina*, *Thyridaria fraxini* Ellis & Everh. [= *Cryptosphaeria eunomia* (Fr.: Fr.) Fuckel var. *fraxini* (Richon) Rappaz, see Rappaz (1987)], which has not yet been combined with *Endoxylina*.

Endoxylina Romell, Bot. Notiser 1892: 173. 1892.

Type: *E. stellulata* (Romell) Romell [= *E. astroidea* (Fr.: Fr.) Romell]

Stromata entirely immersed, widely effused or in pustules, gregarious, scanty to abundant, mixed with host tissue, whitish or concolor with the host tissue, usually with dark zone line to delimit stromata from the surrounding host tissue. Ascomata spherical, black, with eutypoid or valsoid configurations. Ostioles black, conical-papillate, usually with 3-5 sulcations. Asci clavate, long-stipitate, persistent, unitunicate, with eight ascospores in biseriate arrangement. Ascospores brown to dark brown, oblong ellipsoid-inequilateral to allantoid, two- to several-celled, with a thick middle septum, smooth, without germination site or appendages. Hamathecial elements paraphysate, abundant, long, hyaline, septate.

Endoxylina astroidea (Fr.: Fr.) Romell, Fung. Exs. Praes. Scand. no. 168. 1895.

≡ *Sphaeria astroidea* Fr., Kongl. Vetensk. Akad. Handl. 39: 101. 1818; Fr.: Fr., Syst. Mycol. II, p. 478. 1823.

≡ *Eutypa astroidea* (Fr.: Fr.) Rappaz, Mycol. Helvetica 2: 378. 1987.

= *Valsaria stellulata* Romell, Hedwigia 24: 263. 1885.

≡ *Endoxylina stellulata* (Romell) Romell, Bot. Notiser 1892: 173. 1892.

See Rappaz (1987) [as *Eutypa astroidea*] for a description of the teleomorph and anamorph.

SPECIMENS EXAMINED: SWEDEN: Uppland, Uppsala, Botanical Garden, 9.1853, Fries, E.P., decorticated wood (UPS, NEOTYPE [selected by Rappaz (1987)] of *Sphaeria astroidea*); Uppland, Rosersberg, 4.7.1890, Romell, L., Fungi Exsiccati Praeserlim Scandinavici no. 168, decorticated

wood of *Fraxinus excelsior*, as *Endoxylina astroidea* (NY; UPS); Uppland, Österlövsta par., the peninsula Skyttskär, 29.4.1984, Holm, K. & L. 3097a, decorticated wood of *Fraxinus*?, as *Endoxylina astroidea* (UPS); Uppsala, 3.1885, Romell, L., Rabenhorst-Winter, Fungi Europaei no. 3357, decorticated wood of *Fraxinus excelsior* (NY, ISOTYPE of *Valsaria stellulata*); Uppsala, 1884, Romell, L., decorticated wood, as *Valsaria stellulata* (UPS); Uppland, Rosersberg, 5.1890, Romell, L., decorticated wood of *Fraxinus excelsior*, as *Valsaria stellulata* (UPS).

Endoxylina allantospora (Ellis & Everh.) Shoemaker & Egger, Fung. Canad. no. 227. 1982.

≡ *Valsaria allantospora* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 46: 343. 1894.

≡ *Pseudovalsaria allantospora* (Ellis & Everh.) Barr, Mycotaxon 46: 53. 1993.

= *Valsaria coloradensis* Ellis & Everh., Amer. Naturalist 31: 342. 1897.

See Barr (1993) [as *Pseudovalsaria allantospora*] for a description of the teleomorph.

SPECIMENS EXAMINED: U.S.A.: Colorado, Denver, 2.1897, Bethel, E., Fung. Columb. 1134, wood of *Negundo aceroides*, as *Valsaria allantospora* (WSP 13209); Colorado, 12.1896 & 2.1897, Bethel, E., Fung. Columb. 1239, wood of *Negundo aceroides*, as *Valsaria allantospora* (WSP 13208); Kansas, Rockport, 9.4.1894, Bartholomew 1450, dead wood of *Negundo aceroides* (NY [2 pks.], HOLOTYPE of *Valsaria allantospora*); Colorado, Overland, 6.11.1896, Bethel, E. 136, dead bark of *Negundo aceroides* (NY, HOLOTYPE of *Valsaria coloradensis*); Colorado, 1.1897, Bethel, E., dead wood of *Negundo aceroides*, as *Valsaria coloradensis* (NY).

NOTES: *Endoxylina allantospora* and *E. astroidea* have similar ascospore morphology. They differ primarily in ascomatal configurations: the former is valsoid and the latter is eutypoid. Although no anamorph and cultures are known in *E. allantospora*, the sulcate ostioles and long-stipitate, clavate asci suggest a diatrypaceous affinity. *Endoxylina allantospora* is known only in North America, whereas *E. astroidea* is known only from Europe.

PSEUDOTHYRIDARIA PETR.

Pseudothyridaria has long been considered to be a synonym of *Valsaria* (e.g., Clements and Shear, 1931; Müller and von Arx, 1962; Spooner, 1986).

They differ mainly in the former having a trabeculate pseudoparaphysate hamathecium. *Pseudothyridaria* is easily accommodated in the Melanommatales as defined by Barr (1987, 1990b). A generic description is given below.

Pseudothyridaria Petr., Ann. Mycol. 23: 36. 1925.

Type: *P. insitiva* Petr.

Stromata erumpent, pulvinate, gregarious, containing multiple ascomata. Ascomata perithecioid, spherical. Asci persistent, bitunicate, with eight ascospores in uniseriate arrangement. Ascospores brown, ellipsoid to short fusoid, two-celled, delicately ornamented, without germination site and appendages. Hamathecial elements abundant, trabeculate, hyaline, thin, highly interlinked and branched, infrequently septate.

Pseudothyridaria insitiva Petr., Ann. Mycol. 23: 36. 1925.

≡ *Valsaria petrakii* Spooner, Trans. Brit. Mycol. Soc. 86: 408. 1986.

Stromata erumpent from bark, pulvinate, 0.7-3 mm diam x 0.8-1.2 mm high, with conspicuous ascomatal contours; surface black, covered by dark brown substance; interior grayish brown, soft, composed of pseudoparenchymatous cells. Ascomata spherical, 0.3-0.5 mm diam, with a diatrypoid configuration. Ostioles long, up to 0.6 mm long, strongly papillate on stromatal surface. Asci cylindrical, short-stipitate, with eight ascospores arranged in uniseriate manner, 110-125 µm in total length x 7-8 µm broad, the spore-bearing part 90-100 µm. Ascospores brown, two-celled, ellipsoid, constricted at septum, 11.5-14 x 5.5-6.5 µm, with longitudinal ribs. Hamathecial elements 1-1.5 µm broad.

Conidiomata produced between ascomata in stromata, spherical to labyrinthiform, long-necked, 0.4-0.6 mm diam. Conidiophores arranged in palisades, dichotomously branched several times, hyaline to light brown, smooth, 3-4 µm broad. Conidiogenous cells cylindrical to ampuliform, terminal or intercalary, usually arranged in tandem sequences, 6-13 x 3-3.5 µm. Conidia produced holoblastically or from percurrently proliferating conidiogenous cells. Conidia light brown, smooth, unicellular, ellipsoid, 4-6 x 2.5-3 µm.

SPECIMEN EXAMINED: GERMANY: Mähr-Weisskirchen, 10.1913, Petrak, F., bark of *Aesculus* (W, HOLOTYPE of *Pseudothyridaria insitiva*).

NOTES: The anamorph produced in nature fits *Cytospora* Sacc. as defined in Sutton (1980). Petrak and Sydow (1927) referred to the anamorph as *Cytoplea insitiva* (Sacc.) Petr. [≡ *Coniothyrium insitivum* Sacc. ≡ *Haplosporella insitiva* (Sacc.) Sacc.]. According to Farr et al. (1989), *Cytoplea insitiva* is known from Europe and North America.

PSEUDOVALSARIA SPOONER

Spooner (1986) erected and described *Pseudovalsaria* which is based on *P. foedans* (P. Karst.) Spooner. Barr (1994) placed the genus in the Clypeosphaeriaceae. During our study of *Valsaria* and related genera, additional synonyms of *P. foedans* were found and are listed below. *Pseudovalsaria ferruginea* (Nitschke) Rappaz appears to be the earliest name available for this fungus. *Valsaria peckii* (Howe) Sacc. was recently transferred to *Pseudovalsaria* by Barr (1994). *Pseudovalsaria allantospora*

(Ellis & Everh.) Barr appears to have a diatrypaceous affinity, and is accepted as *Endoxylina allantospora* (Ellis & Everh.) Shoemaker & Egger herein.

Pseudovalsaria Spooner, Trans. Brit. Mycol. Soc. 86: 405. 1986.

Type: *P. foedans* (P. Karst.) Spooner [= *P. ferruginea* (Nitschke) Rappaz]

Pseudovalsaria ferruginea (Nitschke) Rappaz, Mycol. Helvetica 7: 159. 1995.

≡ *Anthostoma ferrugineum* Nitschke, Pyren. Germ., p. 118. 1867.

≡ *Camarops ferruginea* (Nitschke) Shear, Mycologia 30: 588. 1938.

≡ *Anthostoma fennicum* P. Karst., Fung. Fenn. Exs. no. 774. 1868.

≡ *Phaeosperma fennica* (P. Karst.) P. Karst., Bidrag Kännedom Finlands Natur Folk: 54. 1873.

≡ *Valsaria fennica* (P. Karst.) Sacc., Syll. Fung. I, p. 752. 1882.

≡ *Phaeosperma foedans* P. Karst., Bidrag Kännedom Finlands Natur Folk: 54. 1873.

≡ *Valsaria foedans* (P. Karst.) Sacc., Syll. Fung. I, p. 748. 1882.

≡ *Pseudovalsa foedans* (P. Karst.) Cooke, Grevillea 14: 55. 1885.

≡ *Pseudovalsaria foedans* (P. Karst.) Spooner, Trans. Brit. Mycol. Soc. 86: 405. 1986.

? = *Phaeosperma niesslii* G. Wint., Hedwigia 13: 131. 1874.

≡ *Valsaria niesslii* (G. Wint.) Sacc., Syll. Fung. I, p. 749. 1882.

≡ *Pseudovalsa niesslii* (G. Wint.) Cooke, Grevillea 14: 55. 1885.

? = *Valsaria anthostomoides* Sacc., Atti Soc. Venet. Trent. Sci. Nat. Padova 4: 18. 1875.

= *Diatrype moroides* Cooke & Peck, Annual Rep. New York State Mus. 29: 63. 1878.

≡ *Valsaria moroides* (Cooke & Peck) Sacc., Syll. Fung. I, p. 750. 1882.

≡ *Endoxylina moroides* (Cooke & Peck) Shoemaker & Egger, Fung. Canad. no. 227. 1982.

= *Valsaria salicina* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 42: 236. 1890.

= *Valsaria lignicola* S. Teng & Ou *apud* S. Teng, Sinensia 7: 515. 1936.

Fide Spooner (1986).

= *Valsaria minor* P. Karst., *ined.*

See Spooner (1986) for a description of the teleomorph.

Colonies on SMEA (Scratch Malt Extract Agar, see Kenerley and Rogers, 1976 for formulation) incubated at ca. 22 C in natural daylight/darkness covering 9 cm Petri dish in 4 weeks, white, velvety to felty, azonate, with diffuse margins; reverse uncolored. Anamorph not produced. Teleomorph produced after six months in stock cultures stored at room temperature in sealed test tubes.

SPECIMENS EXAMINED: CANADA: Ontario, London, 4.1.1890, Dearness, J. 1312, bark of dead *Salix* (NY, HOLOTYPE of *Valsaria salicina*); Ontario, London, Dearness, J. 1312B, *Salix*, as *Valsaria salicina*

(NY); Ontario, London, Dearness, J., *Salix*, as *Valsaria salicina* (NY). FINLAND: Tavastia Australis, Tammela, 9.1868, Karsten, P.A., decorticated wood (H [Fung. Fenn. Exs. 774], LECTOTYPE [selected here]; H [herb. Karsten 3571], ISOLECTOTYPE of *Anthostoma fennicum*). GERMANY: Westfalen, Nienberge bei Münster, 4.1865, Nitschke, T.R.J., decorticated wood (B, HOLOTYPE of *Anthostoma ferrugineum*). NORWAY: 25.6.1982, Mathiassen, G., wood of *Salix borealis* (JDR). SWEDEN: Västmanland. Sala, 4.1887, Starbäck, K., corticated wood of *Alnus*, as *Valsaria minor* P. Karst., *ined.*, and *Valsaria foedans* (P. Karst.) Sacc. (H [herb. Karsten 2755]). TAIWAN: Nan-tou Co., Hsin-yi, Pa-tong-gwang, 7.1.1988, Ju, Y.-M. 77010721, bark of *Alnus formosana* (JDR). U.S.A.: Idaho, near Deary, 1983, Glawe, D., bark of *Alnus tenuifolia*? (JDR); New York, Rensselaer Co., Sandlake, 9.1871, Peck, C.H., branches of *Alnus* (NYS, ISOTYPE of *Diatrype moroides*); New York, Catskill Mts., Sawkill Valley, 13.6.1914, Shear, C.L. 5815, decorticated wood of *Hamamelis virginica*, as *Camarops ferruginea* (BPI); Washington, Soleduck, Olympic Natl. Park, 19.10.1991, Ju, Y.-M., (cultured), decorticated wood of *Betula* (JDR).

NOTES: This fungus has not been observed to be associated with an anamorph either *in vivo* or *in vitro*. The teleomorph was produced in stock cultures after long storage in test tubes. Unfortunately, attempts to repeat the induction of the teleomorph in cultures were not successful.

Rappaz (1995) did not consider *P. foedans* as a synonym of *P. ferruginea* solely because the former often has curved ascospores and the latter does not. This contrast, however, becomes blurred when a number of collections are studied. We believe it probable that they are conspecific.

Karsten's original material of *Phaeosperma foedans* was not located at H. Spooner (1986) reported that there is a piece of Karsten's original material at K. The K specimen is accordingly considered as the lectotype. The type material of *V. anthostomoides* was not located at PAD. From the description in Saccardo (1882), it is possibly the same as *P. ferruginea*.

This fungus is wide spread in northern temperate regions.

Pseudovalsaria peckii (Howe) Barr, Mycotaxon 51: 210. 1994.

≡ *Valsa peckii* Howe *apud* Peck, Annual Rep. New York State Mus. 27: 109. 1877.

≡ *Valsaria peckii* (Howe) Sacc., Syll. Fung. I, p. 746. 1882.

≡ *Pseudovalsa peckii* (Howe) Cooke, Grevillea 14: 55. 1885.

See Barr (1994) for a description of the teleomorph.

SPECIMENS EXAMINED: U.S.A.: Connecticut, near Willimantic, 25.8.1979, Barr, M.E. 6583, *Vaccinium*, as *Valsarioxylon peckii* (Howe) (NY); New Jersey, Newfield, 7.1880, Ellis, J.B., decaying *Kalmia*, as *Valsa peckii* (NY); New Jersey, Ellis, J.B. 171, decaying *Vaccinium corymbosum*, as *Valsa peckii* (NY); New Jersey, Burlington Co., 18.9.1982, Buck, W.R. 8966, dead stems of *Vaccinium corymbosum*, as *Valsaria peckii* (NY); New York, Forestburgh, Peck, C.H., decorticated wood of *Vaccinium corymbosum* and *Kalmia latifolia* (NYS, SYNTYPES of *Valsa peckii*).

NOTES: This species differs from *P. ferruginea* in having larger ascospores, i.e., 13-18 x 5-6 μm vs. 9.5-13 (-14) x 3.5-5 μm , and in having a different host range.

ROUSSOELLA SACC.

Three bamboo-inhabiting fungi that have been combined with *Valsaria* should be excluded from the genus mainly because of their trabeculate hamathecial elements. They appear to be closely related to *Roussoella hysterioides* (Ces.) Höhn. We accordingly make new combinations within that genus. We have also examined the published epithets of *Roussoella* and provide a key to the accepted species. *Roussoella* has commonly been considered to belong to the Amphisphaeriaceae of Pyrenomycetes (e.g., Müller and von Arx, 1973; Wehmeyer, 1975; Aptroot, 1995a). On the other hand, *Roussoella* was synonymized with *Didymosphaeria* Fuckel, a loculoascomycetous genus, by Theissen and Sydow (1915), Saccardo (1926), Clements and Shear (1931), and Hawksworth et al. (1983). *Roussoella* has bitunicate asci and trabeculate hamathecial elements, and we place it in the Didymosphaeriaceae, Melanommatales. *Roussoella* seems to differ from *Didymosphaeria* primarily in usually having multiple ascomata per stroma, in having noticeable stomatal tissue under the clypeus, and in having distinctly longitudinally ribbed or pitted ascospores.

Eight species are accepted here, including two formerly published species --- *R. hysterioides* and *R. scabrispora* (Höhn.) Aptroot, two new species --- *R. alveolata* and *R. intermedia*, three new combinations --- *R. chilensis*, *R. donacicola*, and *R. pustulans*, and one unnamed species. They appear to form a coherent group, highly similar in most characteristics but mainly differentiated from one another by ascospore characters. Among the other published epithets of *Roussoella*, *R. nitidula* Sacc. & Paoletti and *R. verruculosa* Cand. & Katumoto are considered to be synonyms of *R. hysterioides* and *R. donacicola*, respectively. *Roussoella minutella* (Penz. & Sacc.) Aptroot and possibly *R. phyllostachydis* (Hino & Katumoto) Hino & Katumoto are synonyms of *R. pustulans*. *Roussoella amphigena* Rick, *R. bauhinae* (G. Wint.) Höhn., *R. munkii* Speg., and *R. subcoccodes* Speg. were reported from leaves. Since *Roussoella* is highly associated with bamboo culms, these leaf-inhabiting taxa probably are not *Roussoella* species, but we have not examined the materials. All but *R. amphigena* were synonymized with *Pseudothis coccodes* (Lév.) Theiss. & Syd. by Müller and von Arx (1962). *Roussoella bambusae* (Pat.) Monod [= *Diaporthe bambusae* Pat.] and *R. serrulata* (Ellis & G. Martin) Hyde & Aptroot [= *Didymosphaeria serrulata* Ellis & G. Martin] have ascal apical rings that blue in Melzer's iodine reagent and thus probably belong to the Amphisphaeriaceae *sensu lato*. According to Hino and Katumoto (1955), *Roussoella hysterioides* var. *minuta* (Hino & Katumoto) Hino & Katumoto [= *Didymosphaeria striatula* var. *minuta* Hino & Katumoto] differs from the typical variety in having smaller stomata. Aptroot (1995a) believed that this variety is the same as *R. serrulata*. We reserve judgement on this synonymy

because Hino and Katumoto (1955) neither mentioned nor implied that the ascal apical ring of their fungus blues in iodine.

Roussoella Sacc. *apud* Sacc. & Paoletti, Atti Ist. Ven. Sci. ser. 6, 6: 410. 1888.

Type: ***R. nitidula*** Sacc. & Paoletti [= ***R. hysterioides*** (Ces.) Höhn.]

Stromata elliptical, blackish, immersed beneath the host epidermis, gregarious, differentiated into an outer black clypeus which lays immediately beneath the host epidermis, and an inner grayish brown tissue, usually containing multiple ascomata. Ascomata perithecioid, depressed-spherical to, infrequently, spherical. Ostioles inconspicuously or conspicuously papillate. Asci persistent, cylindrical, short-stipitate, bitunicate, with four or eight ascospores in uniseriate arrangement, with apical apparatus fluorescing in fluorescence brightener (Calcofluor). Ascospores light brown to brown, ellipsoid, fusoid to crescentic, equilateral to inequilateral, two-celled, longitudinally ribbed, reticulate, or with pits between ribs, without germination site or appendages. Hamathecial elements abundant, trabeculate, hyaline, thin, highly interlinked and branched, infrequently septate.

KEY TO **ROUSSOELLA** SPECIES

1. Ascospore surface ornamented with pits, or both pits and ribs.....2
1. Ascospore surface ornamented with ribs.....3
2. Ascospores 34-42 x 11-13 μm , with pits between major ribs ***R. alveolata***
2. Ascospores 23-31 x 6.5-8.5 μm , ornamented with pitting in a reticulate fashion ***R. scabrispora***
3. Ribs on ascospores ca. 1 μm broad; ascospores 23-26 x 7-8.5 μm .. ***R. sp.***
3. Ribs on ascospores much less than 1 μm broad.....4
4. Asci containing four ascospores; ascospores 20-25 (-28) x 6.5-8 μm .. ***R. chilensis***
4. Asci normally containing eight ascospores.....5
5. Ascospores 18-24 x 6-7 μm ***R. hysterioides***
5. Ascospores 13.5-18 (-19) x 4.5-5.5 μm ***R. intermedia***
5. Ascospores 9.5-13 x 3.5-4.5 μm ***R. pustulans***
5. Ascospores (6-) 6.5-8 (-8.5) x 3-3.5 μm ***R. donacicola***

Roussoella alveolata Y.-M. Ju, J. D. Rogers, & Huhndorf, *sp. nov.*

Fig. 23

Stromata immersa, denigrata, elliptica, gregaria, 1.5-4 mm longa x 1-3 mm lata x 0.4 mm crassa, omnibus aliquot ascomata contintia. Ascomata sphaerodepressa, 0.7-0.9 mm diam x 0.3 mm alta. Ostiola inconspicua. Asci

octospori, brevistipitati, 265-285 μm longitudine tota x 15-17 μm crassi. Ascosporae brunneae, bicellulares, fusiformes vel lunares, plerumque inequilaterales, apicibus acutae, ad septum constrictae, 34-42 x 11-13 μm , lacunis vadosis 1.5-4 μm diam inter strias longitudinales positae.

Stromata immersed, blackened, elliptical, gregarious, 1.5-4 mm long x 1-3 mm broad x 0.4 mm thick, containing several ascomata. Ascomata depressed-spherical, 0.7-0.9 mm diam x 0.3 mm high. Ostioles inconspicuous. Asci eight-spored, short-stipitate, 265-285 μm in total length x 15-17 μm broad. Ascospores brown, two-celled, fusoid to crescentic, usually inequilateral, with acute ends, constricted at septum, 34-42 x 11-13 μm , with shallow pits, 1.5-4 μm diam, between longitudinal ribs.

SPECIMEN EXAMINED: INDONESIA: Java, Tjibodas, 1907-1908, culms of bamboo, as *Roussoella hysteroioides* (FH, HOLOTYPE of *Roussoella alveolata*); a von Höhnelt slide, one of eight labeled "A. n. 3569, *Roussoella hysteroioides*", from FH also examined.

NOTES: Curiously, this specimen was originally labeled by von Höhnelt as *R. hysteroioides*. This fungus differs from *R. hysteroioides* in having much larger ascospores and in having an ascospore surface with shallow pits between major ribs. The ascospore ornamentation of *R. alveolata* is composed of longitudinal ribs and numerous horizontal links between ribs which give the pits an angular to square appearance. This ornamentation differs from that of *R. scabriscpora* which has more typical reticulate pitting. *Roussoella alveolata* also differs from *R. scabriscpora* in having much larger ascospores and in having larger pits, 1.5-4 μm diam vs. 0.5-2 μm diam. Von Höhnelt obviously examined this material. Interestingly, he considered it conspecific with *R. hysteroioides*.

Roussoella chilensis (Speg.) Y.-M. Ju, J. D. Rogers, & Huhndorf, *comb. nov.* Fig. 25
 = *Valsaria chilensis* Speg., Revista Fac. Agron. Univ. Nac. La Plata, ser. II, 6: 68. 1910.

Stromata 1-2 mm long x 0.5-1.5 mm broad x 0.3 mm thick. Ascomata spherical, 0.2 mm diam. Ostioles conspicuously papillate. Asci four-spored, 95-115 μm in total length x 10-12 μm broad. Ascospores brown, two-celled, oblong-ellipsoid, with narrowly rounded ends, slightly constricted at septum, 20-25 (-28) x 6.5-8 μm , with longitudinal ribs.

SPECIMEN EXAMINED: CHILE: Concepción, 1.1909, Spegazzini, C., culms of *Chusquea quila* (LPS 6015, HOLOTYPE of *Valsaria chilensis*).

NOTES: This fungus is unique among the *Roussoella* species in having four ascospores per ascus. It is otherwise similar to *R. hysteroioides*.

Roussoella donacicola (Speg.) Y.-M. Ju, J. D. Rogers, & Huhndorf, *comb. nov.* Fig. 27
 = *Valsaria donacicola* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 19: 372. 1909.

= *Roussoella verruculosa* Cand. & Katumoto *apud* Cand., Katumoto, & Sherwood-Pike, Sydowia 38: 28-34. 1985.

Stromata 0.2-1 mm long x 0.2-0.5 mm broad x 0.2 mm thick. Ascomata depressed-spherical, 0.2 mm diam x 0.1 mm high. Ostioles slightly papillate. Asci eight-spored, 65-75 μ m in total length x 4-5 μ m broad. Ascospores light brown, two-celled, ellipsoid, with broadly rounded ends, slightly constricted at septum, (6-) 6.5-8 (-8.5) x 3-3.5 μ m, with longitudinal ribs.

SPECIMENS EXAMINED: ARGENTINA: Buenos Aires, Santa Catalina, 4.11.1905, Spegazzini, C., culms of *Arundo donax* (LPS 6001, HOLOTYPE of *Valsaria donacicola*). FRANCE: Hôtel Theas, 33 Bernos-Beaulac, 22.4.1984, Candoussau, F. & Katumoto, K., culms of *Phyllostachys mitis*, as *Roussoella verruculosa* (JDR).

NOTES: *Roussoella verruculosa* was considered to be a synonym of *R. minutella* (Penz. & Sacc.) Aptroot by Aptroot (1995a). However, we consider them to be distinct. The former has a smaller ascospore size range and broader ascospore ends than the latter. *Roussoella verruculosa* and *R. minutella* are synonyms of *R. donacicola* and *R. pustulans*, respectively.

Roussoella hysterioides (Ces.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Cl., Abt. 1, 128: 563. 1919.

Figs. 17-20, 28-32, & 35

≡ *Dothidea hysterioides* Ces., Atti Accad. Sci. Fis. 8: 24. 1879.

≡ *Rhopographus hysterioides* (Ces.) Sacc., Syll. Fung. II, p. 648. 1883.

= *Roussoella nitidula* Sacc. & Paoletti, Atti Ist. Ven. Sci. ser. 6, 6: 410. 1888. *Fide* Müller and von Arx (1962) and Aptroot (1995a).

Stromata elliptical, 1-5 mm long x 1-2 mm broad x 0.3 mm thick. Ascomata depressed-spherical, 0.3-0.5 mm diam x 0.2 mm high. Ostioles inconspicuous. Asci eight-spored, 125-165 μ m in total length x 8-11 μ m broad. Ascospores brown, two celled, oblong-ellipsoid to fusoid, with narrowly rounded ends, slightly constricted at septum, 18-24 x 6-7 μ m, with longitudinal ribs.

Colonies on 2% Difco Oatmeal Agar incubated at 20 C under 12 h fluorescent light covering 9 cm Petri dish in 3 wk, appressed, with diffuse margins, whitish at first, becoming brown, zonate, with abundant dark brown exudate on surface. Reverse grayish brown. Conidiomata formed after 4 wk, stromatic, entirely immersed in mycelia, containing single to multiple locules, 0.4-0.6 mm diam. Conidiophores highly compact, resembling pseudoparenchyma, 4-8 μ m diam, hyaline, smooth. Conidiogenous cells phialidic, hyaline, smooth, ampulliform, 5-7 μ m diam x 7-10 μ m high, arranged in palisades lining cavities of locules. Conidia produced enteroblastically. Conidia hyaline and smooth immediately after seceding from conidiogenous cells, becoming brown and roughened by irregular wings and blisters, ellipsoid, with broadly rounded ends, 8-11 x 5-6.5 μ m, germinating by producing germ hyphae.

SPECIMENS EXAMINED: FRANCE: Pyrénées Atlantiques, Uharte Mixe 64, Parc du Château, 27.2.1994, Candoussau, F. 5395 (CULTURED) and 13.3.1994, Candoussau, F. 289 [received from G. J. Samuels as GS 94-117] (CULTURED), culms of *Phyllostachys* (JDR). INDONESIA: Java, Tjibodas, 1907-1908, culms of bamboo, as *Didymosphaeria striatula* Penz. & Sacc. (FH); Java, Buitenzorg, 1907-1908, culms of bamboo, as *Roussoella hysterioides* = *Didymosphaeria striatula* (FH). TAIWAN: Chi-lan-shan, 5.9.1987, Ju, Y.-M. 76090508, culms of bamboo (JDR); Pa-tung-guan, 7.1.1988, Ju, Y.-M. 77010730, culms of *Yushania niitakayamensis* (JDR).

NOTES: *Roussoella hysterioides*, *R. intermedia*, *R. pustulans*, and *R. donacicola* form a series of species varying in their decreasing ascospore size ranges. See Müller and von Arx (1962) and Aptroot (1995a) for other probable synonyms.

The conidia are intriguing. They are smooth and more or less thin-walled when they secede from the conidiogenous cell (Fig. 35B). An outer wall or wall layer seems to proliferate, forming a loose jacket around the spore. The outer jacket then appears to wrinkle and blister (Fig. 31 & 35B). Examination by transmission electron microscopy shows that the outer wall is formed from the inner wall, remaining attached to it in places and causing wrinkles and blisters (Figs. 28-30). The mechanics of this process, including membrane involvement, were not investigated. At the time of outer wall formation, the inner wall becomes thickened and then appears to divide or otherwise throw off the outer wall (Fig. 30). On some occasions a fractured jacket wall shows the conidium within (Fig. 32). A matrix might at first fill the space between the two walls but at maturity the region between them appears empty, i.e., we visualize it as resembling a beef roast within a loose puffed pastry shell.

Aptroot (1995b) briefly noted that a *Cytoplea* Bizz. & Sacc. anamorph was formed in a culture obtained from Candoussau 5395. Our cultures derived from a duplicate of this collection and Candoussau 289 also have a *Cytoplea* anamorph. Von Höhnelt (1924) described *C. verrucispora* Höhn. from Indonesia and considered it to be the conidial state of *R. hysterioides*. He mentioned that *C. verrucispora* was found between ascomata in larger stromata of *Roussoella*. We have seen three microscope slides of von Höhnelt's material [INDONESIA: Java, Tjibodas, 1908 (FH, HOLOTYPE of *Cytoplea verrucispora*)]. The anamorph that we found in culture in general agrees with von Höhnelt's protologue and slides except for our conidia being smaller, i.e., 8-11 x 5-6.5 µm vs. 12-15 x 6.5-8 µm. Substrates may have caused variations in conidial size. The conidia that we measured are from pure culture, whereas those that von Höhnelt measured are from the natural substrate. Another possible explanation involves von Höhnelt's interpretation of *R. hysterioides*. We have studied some Indonesian specimens identified by von Höhnelt from FH. Two different *Roussoella* were found: *Roussoella alveolata* and *R. hysterioides*. Thus, it is possible that *C. verrucispora* is not the anamorph of *R. hysterioides*.

Roussoella intermedia Y.-M. Ju, J. D. Rogers, & Huhndorf, sp. nov.

Fig. 22

Stromata immersa, denigrata, elliptica, gregaria, 0.6-2 mm longa x 0.6 mm lata x 0.3 mm crassa, omnibus aliquot ascomata contintia. Ascomata sphaerodepressa, 0.3-0.5 mm diam x 0.2 mm alta. Ostiola inconspicua. Asci octospori, brevistipitati, 90-120 μ m longitudine tota x 5.5-7 μ m crassi. Ascosporae brunneae, bicellulares, oblongo-ellipsoideae vel brevifusiformes, apicibus anguste rotundatae, ad septum parum constrictae, 13.5-18 (-19) x 4.5-5.5 μ m, striis longitudinalibus praeditae.

Stromata immersed, blackened, elliptical, gregarious, 0.6-2 mm long x 0.6 mm broad x 0.3 mm thick, containing several ascomata. Ascomata depressed-spherical, 0.3-0.5 mm diam x 0.2 mm high. Ostioles inconspicuous. Asci eight-spored, short-stipitate, 90-120 μ m in total length x 5.5-7 μ m broad. Ascospores brown, two-celled, oblong-ellipsoid to short-fusoid, with narrowly rounded ends, slightly constricted at septum, 13.5-18 (-19) x 4.5-5.5 μ m, with longitudinal ribs.

SPECIMENS EXAMINED: PHILIPPINES: Luzon, Antipolo, 10.1912, Ramos, Rehm: Ascomycetes no. 2107, culms of *Bambusa*, as *Didymosphaeria striatula* Penz. & Sacc. (FH). TAIWAN: Taipei City, Nankong, 23.4.1988, Ju, Y.-M. 77042301, culms of bamboo (JDR); I-lan Co., Yuan-shan, 1.11.1987, Ju, Y.-M. 76110103, culms of *Dendroclamus latiflorus* (WSP, HOLOTYPE of *R. intermedia*).

NOTES: *Roussoella intermedia* has an ascospore size range between that of *R. hysterioides* and *R. pustulans*.

Müller and von Arx (1962) and Aptroot (1995a) treated *Phaedothis gigantochloae* Rehm as a synonym of *R. hysterioides*. Rehm (1914) described *P. gigantochloae* from Luzon, Philippines and gave the ascospore size range 15-18 x 5-6 μ m which is in the size range of *R. intermedia*. The ascospore size range from a type specimen of *P. gigantochloae* [PHILIPPINES: Luzon, Prov. Laguna, Los Baños, 15.7.1913, Baker, C. F. 1257, on *Gigantochloa* (S, SYNTYPE)] is 19-22 x 6.5-7.5 (-8) μ m, larger than the range published by Rehm (1914). We consider *P. gigantochloae* to be a synonym of *R. hysterioides*.

Roussoella pustulans (Ellis & Everh.) Y.-M. Ju, J. D. Rogers, & Huhndorf, *comb. nov.* Fig. 21

≡ *Diatrype pustulans* Ellis & Everh., J. Mycol. 4: 80. 1888.

≡ *Valsaria pustulans* (Ellis & Everh.) Sacc., Syll. Fung. IX, p. 758. 1891; *non* Rehm, 1895.

= *Didymosphaeria minutella* Penz. & Sacc., Malpighia 11: 396. 1897.

≡ *Roussoella minutella* (Penz. & Sacc.) Aptroot, Nova Hedwigia 60: 367. 1995.

? = *Didymosphaeria phyllostachydis* Hino & Katumoto, Bull. Fac. Agric. Yamaguti Univ. 7: 272. 1956.

≡ *Roussoella phyllostachydis* (Hino & Katumoto) Hino & Katumoto, J. Jap. Bot. 40: 85. 1965.

Stromata elliptical, 0.5-6 mm long x 0.5-2 mm broad x 0.3 mm thick. Ascomata depressed-spherical to spherical, 0.2-0.4 mm diam x 0.2 mm high.

Ostioles slightly papillate. Asci eight-spored, 75-105 μm in total length x 5.5-7 μm broad. Ascospores light brown to brown, two-celled, ellipsoid, with narrowly rounded ends, slightly constricted at septum, 9.5-13 x 3.5-4.5 μm , with longitudinal ribs.

SPECIMENS EXAMINED: TAIWAN: A-li-shan, 24.7.1988, Ju, Y.-M. 77072406, culms of bamboo (JDR); Young-ming-shan, 13.12.1987, Ju, Y.-M. 76121304, culms of bamboo (JDR); Pa-tung-guan, 7.1.1988, Ju, Y.-M. 77010731, culms of *Yushania niitakayamensis* (JDR). U.S.A.: Louisiana, St. Martinsville, 7.1888, Langlois, A.B. 1215, dead culms of *Arundinaria* (FH, LECTOTYPE [selected here] of *Diatrype pustulans*).

NOTES: Type material of *Diatrype pustulans* was not located in the Ellis herbarium (NY). A duplicate was found at FH; this is designated as the lectotype. We have not seen the type of *Didymosphaeria minutella* and *D. phyllostachydis*. The former was recently combined with *Roussoella* by Aptroot (1995a). The descriptions and illustrations in Penzig and Saccardo (1904) and Aptroot (1995a) leave little doubt that *D. minutella* is a synonym of *R. pustulans*. Hino and Katumoto (1956) did not mention ornamentation on the ascospores of *D. phyllostachydis*. Candoussau and Katumoto (in Candoussau et al., 1985), while describing *R. verruculosa*, remarked that this species can be distinguished from the "closely related *R. phyllostachydis*" partly by its smaller ascospores. According to this clue and the illustrations that Hino and Katumoto (1956) made, we agree with Aptroot (1995a) in suspecting *R. phyllostachydis* to be a synonym of *R. minutella* and subsequently of *R. pustulans*. Unfortunately, we did not receive a response from YAM on a request for the type of *R. phyllostachydis*.

Roussoella scabrispora (Höhn.) Aptroot, Nova Hedwigia 60: 368. 1995.

Fig. 24

$\equiv$ *Didymosphaeria scabrispora* Höhn., Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Cl., Abt. 1, 118: 1501. 1909.

Stromata elliptical, 1-2 mm long x 0.5-1.5 mm broad x 0.4 mm thick. Ascumata depressed-spherical, 0.8-1.2 mm diam x 0.2-0.3 mm high. Ostioles slightly papillate. Asci eight-spored, 180-210 μm in total length x 10-12 μm broad. Ascospores light brown to brown, two-celled, oblong-ellipsoid, with narrowly rounded ends, slightly constricted at septum, 23-31 x 6.5-8.5 μm , with shallow pits 0.5-2 μm diam.

SPECIMEN EXAMINED: INDONESIA: Java, Buitenzorg, 1907-1908, culms of *Bambusa* (FH, HOLOTYPE of *Didymosphaeria scabrispora*).

NOTES: *Roussoella scabrispora* and *R. alveolata* are the only two species of the genus having pitted ascospores. See the NOTES on *R. alveolata* for comparison between the two species.

Roussoella sp.

Fig. 26

Stromata elliptical, 1-4 mm long x 0.5-1.5 mm broad x 0.4 mm thick. Ascumata depressed-spherical, 0.4-0.6 mm diam x 0.3 mm high. Ostioles

conspicuously papillate. Asci fragmentary. Ascospores brown, two-celled, short-fusoid, with very narrowly rounded or pinched ends, constricted at septum, 23-26 x 7-8.5 μm , with broad longitudinal ribs ca. 1 μm broad.

SPECIMEN EXAMINED: PUERTO RICO: Maricao, 4.1974, Rogers, J.D., culms of *Bambusa* (JDR).

NOTES: This fungus is characterized by the relatively broad ribs on ascospores. It appears to be new. However, the material is scanty and somewhat depauperate, and is not suitable for designating as the holotype.

KEY TO GENERA DISCUSSED HEREIN

1. Asci clearly unitunicate *Endoxylina*
1. Asci bitunicate, but often appearing to be unitunicate..... 2
 2. Hamathecial elements trabeculate, highly branched and interconnected 3
 2. Hamathecial elements paraphysate, infrequently to frequently branched but not notably interconnected..... 4
3. Stromata becoming erumpent..... *Pseudothyridaria*
3. Stromata remaining immersed..... *Roussoella*
4. Ascospores 2-celled, smooth, with a germ pore in one cell *Pseudovalsaria*
4. Ascospores 2-celled, roughened with reticulations or excrescences, lacking a germination site *Valsaria*

LIST OF NAMES OF *VALSARIA*, *VALSONECTRIA*, *MYRMAECIUM*, AND *PHAEOCREOPSIS*

Accepted or suggested disposition is indicated by an asterisk. Probable disposition is indicated by a question mark.

abietinum (*Myrmaecium*) Niessl = ? *Valsaria rubricosa* (Fr.: Fr.) Sacc.

acericola (*Valsaria*) Ellis & Fairm. *apud* Fairm., Proc. Rochester Acad. Sci. 4: 189. 1905.

U.S.A.: New York, Ridgeway, 4.1904, Fairman, branches of *Acer rubrum* (NY, HOLOTYPE of *Valsaria acericola*).

= * *Massariovalsa sudans* (Berk. & M. A. Curtis) Sacc.

actidia (*Valsaria*) Berk. & Ravenel ex Cooke, Grevillea 14: 14. 1885.

U.S.A.: South Carolina, Santa Canal, Ravenel, H.H. 1665, bark of *Carpinus*, as *Melogramma actidia* Berk. & Ravenel, *ined.* (K, LECTOTYPE [selected here] of *Valsaria actidia*).

= * *Dothivalsa megalospora* (Auersw.) Petr.

Cooke (1885b) listed the Ravenel specimens nos. 2331 and 2425 in the protologue and indicated that they are housed at the Berkeley herbarium. However, the only putative type specimen that was sent on request to K is Ravenel no. 1665. We also could not locate the type of

this fungus at FH. Therefore, Ravenel no. 1665 is selected as the lectotype.

aethiops (*Valsaria*) (Cooke & Ellis) Sacc. = *Diatrype aethiops* Cooke & Ellis = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

akebiae (*Valsaria*) Ellis & Everh., N. Amer. Pyren., p. 557. 1892.

U.S.A.: New Jersey, Gloucester Co., Newfield, 22.4.1891, Ellis, J.B., dead vines of *Akebia quinata* (NY, HOLOTYPE of *Valsaria akebiae*).

This is probably a synonym of *Didymosphaeria oblitescens* (Berk. & Broome) Fuckel which was recently redescribed by Aptroot (1995b).

Ascomata are solitary or with several aggregated into pustule.

Ascospores are two-celled, light brown to brown, 12.5-17 x 6-7 µm, not constricted at septum, ornamented with longitudinal striations which are composed of closely spaced fine warts. *Valsaria akebiae* Ellis & Everh. is probably another synonym of *D. oblitescens*. It has ascospores (9-) 11-15 x 5-7 µm, slightly smaller than those of *V. cornicola*, but is otherwise identical to the latter.

allantospora (*Valsaria*) Ellis & Everh. = * *Endoxylina allantospora* (Ellis & Everh.) Shoemaker & Egger = *Pseudovalsaria allantospora* (Ellis & Everh.) Barr

andina (*Valsonectria*) Pat. *apud* Pat. & Lagerh., Bull. Soc. Mycol. France 11: 227. 1895.

This was reported as having hyaline ascospores and is probably not a *Valsaria*.

angularis (*Valsaria*) (Peck) Sacc., Syll. Fung. I, p. 745. 1882.

= *Diatrype angularis* Peck, Bot. Gaz. (Crawfordsville) 5: 36. 1880.

U.S.A.: Vermont, New Haven, 17.5.1879, Pringle, C.G. 209, bark of *Tilia americana* (NYS, HOLOTYPE of *Diatrype angularis*).

= * *Dothivalsaria megalospora* (Auersw.) Petr.

Also see Barr et al. (1986).

anserina (*Valsaria*) (Pers.: Fr.) Sacc., Atti Soc. Venet. Trent. Sci. Nat. Padova 4: 120. 1875.

= *Sphaeria anserina* Pers., Icon. Descr. Fung. I, p. 5. 1798; Pers.: Fr., Syst. Mycol. II, p. 480.

= *Rhynchostoma anserina* (Pers.: Fr.) G. Wint. *apud* Rabenh., Kryptog.-Fl. Deutsch. Oesterr. Schweiz II, p. 763. 1886.

= *Phaeosperma anserinum* (Pers.: Fr.) Traverso, Fl. Ital. Crypt. I, p. 293. 1906.

= *Anthostoma anserinum* (Pers.: Fr.) Petr. & Syd., Ann. Mycol. 27: 113. 1929.

= *Endoxylina anserina* (Pers.: Fr.) E. Müller *apud* E. Müller & Arx, Beitr. Kryptogamenfl. Schweiz 11: 612. 1962.

= *Anthostomella anserina* (Pers.: Fr.) Mycol. Helvetica 7: 109. 1995.

The specimens of *Sphaeria anserina* at L were on loan during our study. The description in Saccardo (1882) [as *Valsaria anserina* (Pers.: Fr.) Sacc.] mentioned ascospores of this fungus being 16-20 x 6-7 µm, with a middle septum. Müller and von Arx (1962) accepted this fungus under *Endoxylina* Romell, a genus with two equal-sized cells in the

ascospore. Clements and Shear (1931) considered this fungus to be the type species of *Phaeosperma* (Sacc.) Traverso [*non* Nitschke ex Fuckel].

By definition, *Phaeosperma* has two equal cells in the ascospore. The Rappaz (1995) interpretation of *S. anserina*, which is quite different from those of Saccardo (1882) and Müller and von Arx (1962), is what he considered to be an *Anthostomella* Sacc., i.e., with ascospores, $(11-) 14.1 \pm 1.3 (-18.5) \times 6-8 \mu\text{m}$, bearing a germ slit and a cellular appendage on one end. He considered those specimens bearing the name *S. anserina* at the Persoon herbarium at L to be misidentified. He then selected a specimen at FH as the neotype. It is arguable whether or not this neotypification is justified owing to the fact that Persoon's authentic specimens are extant at L. If one accepts Rappaz's proposal, *Phaeosperma* (Sacc.) Traverso will become a synonym of *Anthostomella*. In the absence of material supporting the classical definition of *Phaeosperma anserina*, an interpretive type, or epitype, could be selected.

anthostomoides (*Valsaria*) Sacc. = ? *Pseudovalsaria ferruginea* (Nitschke) Rappaz

apatosa (*Valsaria*) (Cooke & Ellis) Sacc., Syll. Fung. I, p. 746. 1882.

≡ *Valsa apatosa* Cooke & Ellis, Grevillea 6: 12. 1877.

≡ *Pseudovalsa apatosa* (Cooke & Ellis) Cooke, Grevillea 14: 55. 1885. U.S.A.: New Jersey, Gloucester Co., Newfield, Ellis, J.B. 3352 [= 2431], branches of *Nyssa multiflora* (NY, ISOTYPE of *Valsa apatosa*); New York, Alcove, 8.1893, Shear, C.L. 344 [4 pks.] & 149, corticated branches of *Nyssa sylvatica*, as *Valsaria apatosa* (NY).

= * *Massariovalsa sudans* (Berk. & M. A. Curtis) Sacc.

apiculata (*Valsaria*) (Curr.) Sacc., Syll. Fung. I, p. 752. 1882.

≡ *Sphaeria apiculata* Curr., Trans. Linn. Soc. London 22: 326. 1859; *non* Wallr., 1831; [*nom. rejic.*, ICBN Art. 64.1].

≡ *Apiorhynchostoma apiculata* (Curr.) Petr., Ann. Mycol. 21: 185. 1923.

≡ *Lopadostoma apiculatum* (Curr.) P. Martin, J. S. African Bot. 42: 75. 1976.

≡ *Rhynchostoma apiculatum* (Curr.) G. Wint. *apud* Rabenh., Kryptog.-Fl. Deutsch. Oesterr. Schweiz II, p. 762. 1887.

≡ *Entosordaria apiculata* (Curr.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Cl., Abt. 1, 129: 166. 1920.

≡ *Sphaeria curreyi* Rabenh., Fung. Europ., no. 250. 1860.

≡ * *Apiorhynchostoma curreyi* (Rabenh.) E. Müller *apud* E. Müller & Arx, Beitr. Kryptogamenfl. Schweiz 11: 707. 1962.

See Rogers et al. (1994).

atrata (*Valsaria*) Sacc. & Briard = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

atrofusca (*Valsaria*) (Schwein.) Sacc., Syll. Fung. IX, p. 759. 1891.

≡ *Sphaeria atrofusca* Schwein., Trans. Amer. Philos. Soc., n. ser., 4: 206. 1832.

≡ * *Nectria atrofusca* (Schwein.) Ellis & Everh., J. Mycol. 1: 140. 1885.

U.S.A.: Pennsylvania, Bethlehem, 1829, Syn. 1429, wood (PH, HOLOTYPE; FH, ISOTYPE of *Sphaeria atrofusca*).

See Shear (1946) and Samuels and Rogerson (1984).

* *bambusae* (*Valsaria*) Kapoor & Gill

batesii (*Valsaria*) Doidge = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

beaumontii (*Valsaria*) (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 753. 1882.

≡ *Hypoxylon beaumontii* Berk. & M. A. Curtis *apud* Berk., Grevillea 4: 93. 1876.

U.S.A.: Alabama, Tuskegee, Beaumont, A. 338 [= 4857], decorticated wood (BPI-CLS [2 slides]; FH, ISOSYNTYPES of *Hypoxylon beaumontii*).

It belongs to *Nemania* S. F. Gray, Xylariaceae.

bignoniae (*Valsaria*) (Schwein.) Cooke, Grevillea 13: 39. 1884.

≡ *Sphaeria bignoniae* Schwein., Schriften Naturf. Ges. Leipzig 1: 29. 1822.

≡ *Valsa bignoniae* (Schwein.) M. A. Curtis, Geol. Nat. Hist. Surv. North Carolina, pt. III, p. 141. 1867.

≡ *Pseudovalsa bignoniae* (Schwein.) Cooke, Grevillea 14: 55. 1885. U.S.A.: North Carolina, Salem, Syn. 1310, Collins Coll. 115, corticated wood (PH, TYPE of *Sphaeria bignoniae*).

A *nomen confusum*. Spielman (1985) mentioned two fungi in the Schweinitz type: *Valsa ceratosperma* (Tode: Fr.) Maire and a *Melanconis* Tul. & C. Tul. The part of type that we examined is among the Collins collections. It is a depauperate *Valsaria insitiva*.

bitorulosa (*Valsaria*) (Berk. & Broome) De Not. *apud* Rabenh., Fung. Europ. no. 932. 1866.

≡ *Valsa bitorulosa* Berk. & Broome, Ann. Mag. Nat. Hist., ser. III, 3: 367. 1859.

≡ *Cryptospora bitorulosa* (Berk. & Broome) Niessl, Hedwigia 16: 119. 1877.

≡ *Diaporthe bitorulosa* (Berk. & Broome) Sacc., Syll. Fung. I, p. 608. 1882.

≡ *Melanconis bitorulosa* (Berk. & Broome) Ellis & Everh., N. Amer. Pyren., p. 522. 1892.

= * *Melanconis chrysostroma* (Fr.) Tul. & C. Tul. *Fide* Wehmeyer (1941).

boldoae (*Valsonectria*) Speg., Revista Fac. Agron. Univ. Nac. La Plata, ser. II, 6: 98. 1910.

According to G. J. Samuels (pers. comm.), this fungus appears to be a *Nectriella* Nitschke ex Fuckel.

cannae (*Myrmaecium*) Dearn. & Barth., Mycologia 9: 347. 1917.

PUERTO RICO: Cabo Rojo, 30.10.1912, Stevens, F.L., Fung. Columb. 5038, leaves of *Canna indica* (WSP 4089, TYPE of *Myrmaecium cannae*).

This leaf-inhabiting fungus is not a *Valsaria*. Petrak (1927) synonymized it with *Eudarluka australis* Speg.

caproni (*Valsaria*) (Cooke) Berl. & Voglino, Add. Syll. Fung., p. 131. 1886.

≡ *Pseudovalsa caproni* Cooke, Grevillea 14: 48. 1885.

Wehmeyer (1941) thought that this is a good *Valsaria*. The type at K was on loan during our study.

cariei (*Valsaria*) Sacc., Atti Soc. Venet. Trent. Sci. Nat. Padova 4: 19. 1875.

≡ *Phaeosperma cariei* (Sacc.) Traverso, Fl. Ital. Crypt. I, p. 293. 1906.

ITALY: Padova, decorticated rotten wood (PAD, HOLOTYPE of *Valsaria cariei*).

The type of *V. cariei* is the same as that of *Rhynchostoma julii* Fabre f. *vestitum* Rehm [EUROPE: 10-11.1888, Rehm's Ascomyceten 1030, leg. Wegelin, decorticated wood (NY, ISOTYPE)]. The latter name was synonymized with *Lojkania melasperma* (Cooke) Barr by Barr (1984). We observed a germ slit on both cells of the ascospore which was not documented in Barr (1984).

celtidis (*Valsaria*) (Cooke) Sacc. ≡ *Valsa celtidis* Cooke ≡ *Pseudovalsa*

celtidis (Cooke) Cooke = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

chilensis (*Valsaria*) Speg. ≡ * *Roussoella chilensis* (Speg.) Y.-M. Ju, J. D.

Rogers, & Huhndorf

cincta (*Valsaria*) (Curr.) Sacc. ≡ *Sphaeria cincta* Curr. ≡ *Diatrype cincta*

(Curr.) Berk. & Broome ≡ *Myrmaecium cinctum* (Curr.) Lindau = *

Valsaria insitiva (Tode: Fr.) Ces. & De Not.

cinnamomi (*Valsaria*) (Ces.) Sacc. ≡ *Melogramma cinnamomi* Ces. ≡

Valsonectria cinnamomi (Ces.) Huhndorf = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

citri (*Valsaria*) Rehm = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

clavatiasca (*Valsaria*) Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 17: 123. 1908.

ARGENTINA: Misiones, San Pedro, 2.1907, Spegazzini, C., branches of *Ilex paraguayensis* (LPS 6022 [2 pks.], HOLOTYPE of *Valsaria clavatiasca*).

Valsaria discoidea Rehm, *V. natalensis* Doidge, and *V. subtropica* Speg. are synonyms. A description is given as follows: Stromata immersed to erumpent, containing one to several ascomata, 0.3-1 mm diam; surface whitish to grayish, becoming dull grayish brown with age; interior with soft, white tissue distributed around ostiole and with the space between ascomata occupied by the host tissue. Ascomata spherical, 0.2 mm diam, solitary or aggregated with a valsoid to diatrypoid configuration. Ostioles short, barely raised. Asci clavate, with eight ascospores arranged in partially biseriate manner, 100-125 x 12-17 µm, the spore-bearing part 45-70 µm, with ectotunica frequently broken at stipe. Ascospores brown, two-celled, short-fusoid, constricted at septum, 15-20 x 5.5-8 µm, with a very fine dash-line-like ornamentation. Hamathecia trabeculate, interlinked, hyaline, 1-1.5 µm broad.

This fungus belongs to the Melanommatales Barr. Its long-stipitate, clavate asci are reminiscent of those of *Hypsostroma* Huhndorf (Huhndorf, 1992b) and *Xylobotryum* Pat. (Ju and Rogers, 1994).

clethraecola (Valsaria) (Cooke & Ellis) Sacc. = **Valsa clethraecola** Cooke & Ellis = **Pseudovalsa clethraecola** (Cooke & Ellis) Cooke = * **Valsaria insitiva** (Tode: Fr.) Ces. & De Not.

collematoides (Valsaria) (Berk. & Ravenel) Berl. & Voglino, Add. Syll. Fung., p. 131. 1886.

= **Botryosphaeria collematoides** Berk. & Ravenel ex Cooke, Grevillea 13: 102. 1885.

= **Sphaeria collematoides** Berk. & M. A. Curtis, *ined.*

U.S.A.: South Carolina, Santee Canal, Ravenel, H.W. 1542, parasitizing **Hypoxylon perforatum** (Schwein.: Fr.) Fr., as **Sphaeria collematoides** B. & C., *ined.* (FH, TYPE of **Botryosphaeria collematoides**); South Carolina, Santee Canal, 2.1850, Ravenel, H.W. 923 [= 2960], parasitizing a **Hypoxylon** growing on branches of **Fagus**, as **Sphaeria collematoides** B. & C., *ined.* (FH, TYPE of **Botryosphaeria collematoides**).

= * **Immotthia atrograna** (Cooke & Ellis) Barr. See Barr (1993) for a description of this fungus.

colludens (Valsaria) Rehm, Leaf. Philipp. Bot. 6: 2217. 1914.

This was originally reported from culms of **Gigantochloae**. The type was not located at S. In the protologue, this fungus was described as having asci bluing in iodine solution, having ascospores 30-35 x 15-17 µm, and having a sheath surrounding the ascospore. This may represent an **Amphisphaeria** Ces. & De Not.

coloradensis (Valsaria) Ellis & Everh. = * **Endoxylina allantospora** (Ellis & Everh.) Shoemaker & Egger

complexa (Valsaria) (Mont.) Sacc., Syll. Fung. I, p. 747. 1882.

= **Valsa complexa** Mont., Ann. Sci. Nat. Bot., sér. II, 20: 370. 1843.

= **Pseudovalsa complexa** (Mont.) Cooke, Grevillea 14: 55. 1885.

The type was not located at PC.

consors (Valsaria) Rehm = * **Valsaria insitiva** (Tode: Fr.) Ces. & De Not.

cornicola (Valsaria) Ellis & Everh., N. Amer. Pyren., p. 741. 1892.

CANADA: Ontario, London, 23.12.1891, Dearness, J. 994, rotten wood of **Cornus stolonifera** (NY, HOLOTYPE of **Valsaria cornicola**).

See **V. akebiae** herein.

cryptomeriae (Valsaria) Kar & Maity = * **Valsaria insitiva** (Tode: Fr.) Ces. & De Not.

decipiens (Valsaria) Auersw., *ined.*

= * **Cryptodiaporthe salicella** (Fr.: Fr.) Petr. *Fide* Wehmeyer (1933) [as **Cryptodiaporthe salicella** (Fr.: Fr.) Wehmeyer].

decorticans (Myrmaecium) Hino & Katumoto, Bull. Fac. Agric. Yamaguti Univ. 6: 50. 1955.

We did not receive a response on a request for the type from YAM where the type is presumably deposited. This fungus was originally reported from culms of **Phyllostachys reticulata**.

decorticans (Valsaria) (Kunze ex Ces. & De Not.) Bagl., Ces., & De Not. = **Sphaeria decorticans** Kunze ex Ces. & De Not. = * **Valsaria fulvopruinata** (Berk.) Sacc.

decorticans (*Valsaria*) (Fr.: Fr.) Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 205. 1863; *non* (Kunze ex Ces. & De Not.) Bagl., Ces., & De Not., 1865.

≡ *Sphaeria decorticans* Fr., Kongl. Vetensk. Acad. Handl. 38: 95. 1817; Fr.: Fr., Syst. Mycol. II, p. 396. 1823; *non* Kunze ex Ces. & De Not., 1863.

≡ *Valsa decorticans* (Fr.: Fr.) Fr., Summa Veg. Scand. II, p. 412. 1849.

= * *Valsa ceratosperma* (Tode: Fr.) Maire. *Fide* Farr et al. (1989).

diospyri (*Valsaria*) (Schwein.: Fr.) De Not., Comment. Soc. Crittog. Ital. 2: 482. 1867.

≡ *Sphaeria diospyri* Schwein., Schriften Naturf. Ges. Leipzig 1: 32. 1822; Schwein.: Fr., Syst. Mycol. II, p. 372. 1823.

U.S.A.: North Carolina, Salem, Syn. 1289, corticated wood (PH, HOLOTYPE of *Sphaeria diospyri*).

A *Valsaria*. However, the type is so depauperate that its identity cannot be determined. The ascospores have conspicuous reticulations which are usually encountered in *V. fulvopruinata* and *V. rubricosa*. The Collins collection no. 90 at PH, also labelled as *Sphaeria diospyri*, from Salem, North Carolina, is not a *Valsaria*. It is probably a *Pseudovalsa* Ces. & De Not.

discoidea (*Valsaria*) Rehm, Leaf. Philipp. Bot. 6: 2216. 1914.

PHILIPPINES: Los Baños, 14.10.1913, Reyes, S.A. 1773, fallen dead limbs (S, HOLOTYPE of *Valsaria discoidea*).

A synonym of *Valsaria clavatiasca* Speg.

donacicola (*Valsaria*) Speg. ≡ * *Roussoella donacicola* (Speg.) Y.-M. Ju, J. D. Rogers, & Huhndorf

donacina (*Valsaria*) (Fr.: Fr.) Ces. & De Not., Comment. Soc. Crittog. Ital. 1: 205. 1863.

≡ *Sphaeria donacina* Fr., Linnaea 5: 545. 1830; Fr.: Fr., Syst. Mycol. Index, p. 164. 1832.

≡ *Pseudovalsa donacina* (Fr.: Fr.) Cooke, Grevillea 14: 55. 1885.

ITALY: Liguria, Genova, 1845, De Notaris, G., ad donacis, as *Sphaeria donacina* (UPS).

A *nomen dubium*. Saccardo (1882) mentioned that, according to Montagne, Fries' *Sphaeria donacina* is a sphaeropsidaceous fungus. He then credited De Notaris as the author of *S. donacina*. The only specimen located at UPS is a De Notaris collection which is identical to *Valsaria insitiva*.

durissima (*Valsaria*) (Fuckel) Sacc. ≡ *Myrmaecium durissimum* Fuckel ≡ *Pseudovalsa durissima* (Fuckel) Cooke = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

endoleucum (*Myrmaecium*) Sacc., Michelia 2: 138. 1880.

≡ *Myrmaeciella endoleuca* (Sacc.) Lindau *apud* Engl. & Prantl, Nat. Pflanzenfam. I, p. 478. 1897.

≡ *Hypocreopsis endoleuca* (Sacc.) E. Müller, *apud* E. Müller & Arx, Beitr. Kryptogamenfl. Schweiz 11: 651. 1962.

According to G. J. Samuels (pers. comm.), the type of this fungus at PAD has hyaline, warted ascospores. It is unlikely to be a *Valsaria*.

endophaeum (Myrmaecium) Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 268. 1898.

ARGENTINA: Buenos Aires, Santa Catalina, Vereno, 1889, Spegazzini, C., bark of *Gleditschia triacanthos* (LPS 5779, HOLOTYPE of *Myrmaecium endophaeum*).

This fungus has hyaline ascospores and unitunicate asci. It is not a *Valsaria*.

eucalypti (Valsaria) (Kalchbr. & Cooke) Sacc. = *Melogramma eucalypti* Kalchbr. & Cooke = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

eucalypti (Valsaria) (Kalchbr. & Cooke) Sacc. f. *lusitanica* Gonz. Frag. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

exasperans (Valsaria) (W. Gerard) Sacc. = *Diatrype exasperans* W. Gerard = * *Valsaria fulvopruinata* (Berk.) Sacc.

exasperans (Valsaria) (W. Gerard) Sacc. var. *aceris* Rehm = * *Valsaria fulvopruinata* (Berk.) Sacc.

farlowiana (Valsaria) Sacc. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

fennica (Valsaria) (P. Karst.) Sacc. = *Anthostoma fennicum* P. Karst. = *Phaeosperma fennica* (P. Karst.) P. Karst. = * *Pseudovalsaria ferruginea* (Nitschke) Rappaz

foedans (Valsaria) (P. Karst.) Sacc. = *Phaeosperma foedans* P. Karst. = *Pseudovalsa foedans* (P. Karst.) Cooke = *Pseudovalsaria foedans* (P. Karst.) Spooner = * *Pseudovalsaria ferruginea* (Nitschke) Rappaz

fraxineum (Myrmaecium) Ellis & Everh., J. Mycol. 9: 168. 1903.

This was originally reported as having hyaline ascospores. It is probably not a *Valsaria*.

fraxini (Valsaria) Hazsl., *ined.*

= * *Diaporthe pustulata* (Desmaz.) Sacc. *Fide* Wehmeyer (1933).

* **fulvopruinata (Valsaria)** (Berk.) Sacc. = *Sphaeria fulvopruinata* Berk. = *Valsa fulvopruinata* (Berk.) Cooke = *Diaporthe fulvopruinata* (Berk.) Sacc. = *Pseudovalsa fulvopruinata* (Berk.) Cooke

gemmata (Valsaria) (Berk. & Ravenel) Ellis & Everh. = *Hypoxylon gemmatum* Berk. & Ravenel = *Melogramma gemmata* (Berk. & Ravenel) Cooke = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

gleditschiae (Valsaria) (Schwein.: Fr.) Ellis & Everh., N. Amer. Pyren., p. 564. 1892.

= *Sphaeria gleditschiae* Schwein., Schriften Naturf. Ges. Leipzig 1: 40. 1822; Schwein.: Fr., Syst. Mycol. II, p. 421. 1823.

U.S.A.: North Carolina, Salem, Syn. 1435, corticated branches (PH, HOLOTYPE of *Sphaeria gleditschiae*).

A sphaeropsidaceous fungus. Shear (1939) concluded that this is a *Sphaeropsis* Sacc. which was considered to be conspecific with *S. malorum* Peck by Stevens (1933). The latter name was in turn listed as a synonym of *Diplodia mutila* (Fr.: Fr.) Mont. by Farr et al. (1989).

grandinea (Valsaria) (Berk. ex Cooke) Berl. & Voglino, Add. Syll. Fung., p. 130. 1886.

= *Melogramma grandinea* Berk. ex Cooke, Grevillea 13: 103. 1885.

= *Sphaeria grandinea* Berk. & M. A. Curtis, *ined.*

U.S.A.: Pennsylvania, Michener 4353, parasitizing a *Hypoxylon* which grows on the wood of *Fraxinus*, as *Sphaeria grandinea* Berk. & M. A. Curtis, *ined.* (K, LECTOTYPE [selected here] of *Melogramma grandinea*).

= * *Immotthia atrograna* (Cooke & Ellis) Barr. See Barr (1993) for a description of this fungus.

Cooke (1885a), while publishing *Melogramma grandinea*, referred to *Melogramma insidens* on page 99 in Berkeley (1876) and cited specimen no. 9020 from the Berkeley herbarium as the type. The only specimen that was sent by K on request for the type is the Michener specimen no. 4353 which was listed under *Melogramma insidens* by Berkeley (1876). This specimen is selected to be the lectotype of *Melogramma grandinea*.

gregalis (*Valsaria*) (Schwein.: Fr.) Sacc., Syll. Fung. I, p. 752. 1882.

= *Sphaeria gregalis* Schwein.: Fr. *apud* Fr., Elench. Fung. II, p. 68. 1828.

= *Hypoxylon gregale* (Schwein.: Fr.) M. A. Curtis, Geol. Nat. Hist. Surv. North Carolina, pt. III, p. 140. 1867.

U.S.A.: Carolina, Syn. 1211, decorticated wood (PH, HOLOTYPE of *Sphaeria gregalis*); North Carolina, Salem, decorticated wood (UPS 57701, ISOTYPE of *Sphaeria gregalis*).

A *Hypoxylon* Bull. It is in such depauperate condition that it cannot be identified.

haraeana (*Valsaria*) (Syd. & P. Syd.) Syd. *apud* Theiss. & Syd., Ann. Mycol. 13: 339. 1915.

= *Dothidea haraeana* Syd. & P. Syd., Ann. Mycol. 11: 267. 1913.

The type was not located at S. Its identity is uncertain.

harperianum (*Myrmaecium*) Rehm, Ann. Mycol. 7: 532. 1909.

This fungus was originally reported as having hyaline ascospores and is probably not a *Valsaria*.

hohnelianum (*Myrmaecium*) (Rick) Sacc. & Traverso, Syll. Fung. XX, p. 1275. 1911.

= *Myrmaeciella hohneliana* Rick *apud* Theiss., Ann. Mycol. 8: 456. 1910.

This was originally reported as having hyaline ascospores and is probably not a *Valsaria*.

hookeri (*Valsaria*) (Cooke) Berl. & Voglino, Add. Syll. Fung., p. 130. 1886.

= *Melogramma hookeri* Cooke, Grevillea 13: 103. 1885.

= *Myrmaecium hookeri* (Cooke) Lindau *apud* Engl. & Prantl, Nat. Pflanzenfam. I, p. 480. 1897.

MOROCCO: Grand Atlas, 5.1871, Hooker, corticated wood (K, HOLOTYPE of *Melogramma hookeri*).

This fungus fits *Dothidea* Fr.

hurae (*Valsaria*) (Henn.) Höhn. = *Hypoxylonopsis hurae* Henn. = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

hypoxyloides (*Myrmaecium*) Rehm = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

hypoxyloides (*Phaeocreopsis*) (Speg.) Sacc. & Syd. = *Hypocreopsis hypoxyloides* Speg. = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

hypoxyloides (*Valsaria*) Ellis & Everh. non Rehm = *Valsonectria hypoxyloides* (Ellis & Everh.) Barr = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

hypoxyloides (*Valsaria*) Rehm non Ellis & Everh. = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

hysterioides (*Valsaria*) Rehm, Hedwigia 21: 75. 1882.

GERMANY: Bavaria (Bayern), 7.1881, Arnold, Rehm: Ascomyceten 633, decorticated wood of *Sorbus chamaemespilus* (S, HOLOTYPE; NY, ISOTYPE of *Valsaria hysterioides*).

Stromata are immersed, slightly elevating the covering host tissue and giving the appearance of certain hysteriaceous fungi. Each stroma contains several locules. The centrum is composed of bitunicate asci and cellular pseudoparaphysate hamathecial elements. It belongs to the Pleosporales *sensu* Barr (1987). There is a perithecioid fungus growing on the surface of *V. hysterioides*. Its identity can not be established owing to its poor condition.

indica (*Valsaria*) Kale = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

insidens (*Myrmaecium*) (Schwein.: Fr.) Sacc., Syll. Fung. I, p. 601. 1882.

= *Sphaeria insidens* Schwein., Schriften Naturf. Ges. Leipzig. 1: 39.

1822; Schwein.: Fr., Syst. Mycol. II, p. 422. 1823.

= *Hypoxylon insidens* (Schwein.: Fr.) Ellis & Everh., N. Amer. Pyren., p. 653. 1892.

= *Melogramma insidens* (Schwein.: Fr.) Berk., Grevillea 4: 99. 1876.

= *Fuckelia insidens* (Schwein.: Fr.) Cooke, Grevillea 12: 52. 1883.

U.S.A.: North Carolina, Salem & Pennsylvania, Bethlehem, Syn. 1436,

(PH, HOLOTYPE; K [as no. 9011], ISOTYPE of *Sphaeria insidens*);

Pennsylvania, Bethlehem, Syn. 1436, Collins Coll. 180, as *Sphaeria insidens* (PH).

= * *Immotthia atrograna* (Cooke & Ellis) Barr. See Barr (1993) for a description of this fungus.

* *insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. = *Sphaeria insitiva* Tode: Fr.

= *Myrmaecium insitivum* (Tode: Fr.) Lindau

insitiva (*Valsaria*) (Tode: Fr.) Ces. & De Not. f. *acaciae-caveniae* Speg. = *

Valsaria insitiva (Tode: Fr.) Ces. & De Not.

insitiva (*Valsaria*) (Tode: Fr.) Ces. & De Not. f. *carpini-betuli* Sacc. = *

Valsaria insitiva (Tode: Fr.) Ces. & De Not.

insitiva (*Valsaria*) (Tode: Fr.) Ces. & De Not. f. *celtidis* Sacc. = * *Valsaria*

insitiva (Tode: Fr.) Ces. & De Not.

insitiva (*Valsaria*) (Tode: Fr.) Ces. & De Not. var. *coluteae* Sacc. = *

Valsaria insitiva (Tode: Fr.) Ces. & De Not.

insitiva (*Valsaria*) (Tode: Fr.) Ces. & De Not. f. *cordiae-gerascanthi* Speg.

= * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

insitiva (*Valsaria*) (Tode: Fr.) Ces. & De Not. f. *deminuta-negundinis* Sacc.

= * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. fraxini-orni* Sacc. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. gleditschiae* Speg. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. gleditschiae-triacanthi*
 Sacc. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *var. linderiae* Sacc. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. mimosae-polycarpae* Speg.
 = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. mori-albae* Sacc. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. paliuri-aculeati* Sacc. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. parkinsoniae* Speg. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. polygoni* Speg. = * *Valsaria*
insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. quercus-pedunculatae*
 Sacc. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. rauwolfiae* Speg. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. robiniae-pseudacaciae*
 Sacc. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. ulmi-campestris* Sacc. = *
Valsaria insitiva (Tode: Fr.) Ces. & De Not.
- insitiva* (*Valsaria*) (Tode: Fr.) Ces. & De Not. *f. wistariae* Sacc. = * *Valsaria*
insitiva (Tode: Fr.) Ces. & De Not.
- kriegeriana* (*Valsaria*) Rehm, Hedwigia 42: 159. 1903.
 GERMANY: Königstein, 26.9.1899, Krieger, W. 19, twigs of *Sambucus*
nigra, as *Valsaria kriegeri* (S, HOLOTYPE of *Valsaria kriegeriana*);
 Königstein, 26.9.1899, Krieger, W., Fung. Saxon. 1617, twigs of
Sambucus nigra (S [herbs. Rehm & Sydow], ISOTYPES of *Valsaria*
kriegeriana).

A unitunicate fungus. It is probably close to *Hyponectria* Sacc.

- kunzeana* (*Valsaria*) De Not. = *Pseudovalsa kunzeana* (De Not.) Cooke = *
Valsaria fulvopruinata (Berk.) Sacc.
- latitans* (*Valsaria*) Sacc., Rend. Congr. Botan. Palermo, p. 52. 1902.
 FRANCE: Rigny, Flogcoler 21, decorticated wood of *Salix* or *Populus*
 (PAD, HOLOTYPE of *Valsaria latitans*).

This fungus has ascomata entirely immersed in decorticated wood and arranged in oblong patches. The configuration of ascomata is eutypoid. Asci are bitunicate, 8-spored, and clavate. Hamathecial tissue is trabeculate, septate, and 1.5-2 µm broad. Ascospores are two-celled, brown, short-fusoid, very finely warted, 28-33 x 6-8 µm, constricted at septum, and have a thin layer of hyaline gelatinous sheath. *Valsaria latitans* probably belongs to *Didymosphaeria* Fuckel.

leonensis (*Valsaria*) Deighton *apud* Petr. & Deighton, Sydowia 6: 300. 1952.
 = **Macrovalsaria leonensis** (Deighton) Petr., Sydowia 15: 300. 1962.
 = * **Macrovalsaria megalospora** (Mont.) Sivanesan. *Fide* Sivanesan (1975).

Type material of *V. leonensis* was not located at IMI.

lignicola (*Valsaria*) S. Teng & Ou = * **Pseudovalsaria ferruginea** (Nitschke) Rappaz

magnoliae (*Valsaria*) Ellis & Everh., J. Mycol. 10: 170. 1904.

CANADA: Ontario, London, 12.1903, Dearness, J. 2082, **Magnolia** cult (NY, HOLOTYPE of *Valsaria magnoliae*); Ontario, London, 12.1903, Dearness, J., Fung. Columb. 2100, as **Valsaria magnoliae** (NY).

Probably a **Massariovalsa** Sacc.

majuscula (*Valsaria*) Cooke & Harkn., Grevillea 13: 17. 1884.

= **Pseudovalsa majuscula** (Cooke & Harkn.) Cooke, Grevillea 14: 55. 1885.

U.S.A.: California, Harkness, W.H. 1997, branches of **Salix** (K, HOLOTYPE of *Valsaria majuscula*).

= * **Massariovalsa californica** (Wehmeyer) Barr. See Barr (1978) for a description of this fungus.

massarioides (*Valsaria*) Penz. & Sacc., Malpighia 11: 503. 1897.

INDONESIA: Java, Tjibodas, 8.3.1897, no. 130, corticated and decorticated wood (PAD, HOLOTYPE of *Valsaria massarioides*).

No asci were found in this material. However, its disposition in *Valsaria* is unjustified because the ascomata do not form a compound structure and are not embedded in stromatal tissue.

mata (*Valsaria*) Rolland = ? **Valsaria insitiva** (Tode: Fr.) Ces. & De Not.

megalospora (*Valsaria*) Auersw., Leipz. Bot. Tauschver, p. 5. 1866.

= * **Dothivalsa megalospora** (Auersw.) Petr., Sydowia 19: 283. 1966. *Fide* Barr (1978, 1987).

= **Massariovalsa megalospora** (Auersw.) E. Müller *apud* E. Müller & Arx, Beitr. Kryptogamenfl. Schweiz 11: 730. 1962.

= **Myrmaecium megalosporum** (Auersw.) Niessl, Beitr. z. Kenntn. d. Pilze, p. 55. 1876.

= **Pseudovalsa megalosporum** (Auersw.) Cooke, Grevillea 14: 55. 1885.

melastroma (*Valsaria*) (Fr.: Fr.) Sacc., Syll. Fung. I, p. 745. 1882.

= **Sphaeria melastroma** Fr.: Fr., Syst. Mycol. II, p. 399. 1823.

= **Valsa melastroma** (Fr.: Fr.) Fr., Summa Veg. Scand. II, p. 412. 1849.

= **Pseudovalsa melastroma** (Fr.: Fr.) Cooke, Grevillea 14: 55. 1885.

SWEDEN: Sclerom. Suec. 223, corticated wood (UPS, HOLOTYPE of *Sphaeria melastroma*).

= * **Prosthecium appendiculatum** (Otth) Barr. See Wehmeyer (1941) for a description of this fungus.

moroides (*Valsaria*) (Cooke & Peck) Sacc. = **Diatrype moroides** Cooke &

Peck = **Endoxylina moroides** (Cooke & Peck) Shoemaker & Egger = *

Pseudovalsaria ferruginea (Nitschke) Rappaz

minor (*Valsaria*) P. Karst., *ined.* = * *Pseudovalsaria ferruginea* (Nitschke) Rappaz
mundkurina (*Valsaria*) Muderji & Kapoor = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

muroianum (*Myrmaecium*) Hino & Katumoto, Bull. Fac. Agric. Yamaguti Univ. 10: 1194. 1959.

We did not receive a response on a request for the type from YAM where the type is presumably deposited. This fungus was originally reported from culms of *Pleioblastus simoni*.

natalensis (*Valsaria*) Doidge, Bothalia 4: 73. 1941.

SOUTH AFRICA: Natal Prov., Donnybrook, Xumeni Forest, 2.1935, Doidge, E.M. & Morgan, K.E., dead wood (PREM 28931 [2 slides], LECTOTYPE of *Valsaria natalensis*); Natal Prov., Donnybrook, Xumeni Forest, 28.6.1938, Morgan, K.E. & Doidge, E.M., dead wood (PREM 30373 [2 slides], PARATYPE of *Valsaria natalensis*).

A synonym of *Valsaria clavatiasca* Speg.

niesslii (*Valsaria*) (G. Wint.) Sacc. = *Phaeosperma niesslii* G. Wint. = *Pseudovalsa niesslii* (G. Wint.) Cooke = * *Pseudovalsaria ferruginea* (Nitschke) Rappaz

nigrofacta (*Valsaria*) (Cooke & Ellis) Sacc. = *Valsa nigrofacta* Cooke & Ellis = *Pseudovalsa nigrofacta* (Cooke & Ellis) Cooke = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

nigrospora (*Valsaria*) (Peck) Berl. & Voglino, Add. Syll. Fung., p. 129. 1886. = *Diatrype nigrospora* Peck, Annual Rep. New York State Mus. 33: 33. 1883.

= *Melanconiella nigrospora* (Peck) Dearn. & House, New York State Mus. Bull. 266: 81. 1925.

= *Melanconis nigrospora* (Peck) Wehmeyer, Mycologia 32: 327. 1940.

= * *Chapectia nigrospora* (Peck) Barr, Mycol. Mem. 7: 165. 1978.

U.S.A.: New York, Quaker Street, 6.1879, Peck, C.H., dead branches of *Betula lutea* (NYS, HOLOTYPE of *Diatrype nigrospora*).

This fungus is associated with *Asterosporium betulinum* Peck in the type material.

notarisii (*Valsaria*) (Mont.) Sacc. = *Sphaeria notarisii* Mont. = *Valsa notarisii* (Mont.) Mont. = *Pseudovalsa notarisii* (Berk.) Cooke = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

nudicollis (*Valsaria*) (Berk. & M. A. Curtis) Sacc., Syll. Fung. I, p. 753. 1882. = *Hypoxylon nudicolle* Berk. & M. A. Curtis *apud* Berk., Grevillea 4: 93. 1876.

= *Sphaeria nudicollis* Berk. & M. A. Curtis, *ined.*

U.S.A.: South Carolina, Society Hill, 2.1851, Curtis, M.A. 3275, decorticated wood of *Pinus*, as *Sphaeria nudicollis* B. & C. *ined.* (FH, ISOTYPE of *Hypoxylon nudicolle*).

= * *Endoxyla parallela* (Fr.: Fr.) Sacc. See Untereiner (1993) for a description of this fungus.

oleifera (*Valsaria*) Tul. & C. Tul. ex Sacc., Syll. Fung. I, p. 747. 1882.

≡ *Valsa oleifera* Tul. & C. Tul., Sel. Fung. Carp. II, 197. 1863; [*nom. inval.*, ICBN Art. 34.1].

≡ *Pseudovalsa oleifera* (Tul. & C. Tul. ex Sacc.) Cooke, Grevillea 14: 55. 1885.

FRANCE: 1851-1862, bark of *Populus*, as *Sphaeria oleifera* Tul. & C. Tul., *ined.* (PC, SYNTYPES of *Valsaria oleifera*).

Type material of this fungus is glued on 14 paper cards which in turn are attached on six herbarium sheets. Except for one paper card on which small branches are stuck, others have material of a *Prosthecium* Fresen. Tulasne and Tulasne (1863) did not purposely introduce *Valsa oleifera* which was mentioned in a footnote with a brief diagnosis of the ascospore morphology. Saccardo (1882) formally published a short diagnosis for this fungus under *Valsaria* which was apparently excerpted from Tulasne and Tulasne (1863).

orbiculata (*Valsonectria*) Syd. & P. Syd., Ann. Mycol. 14: 86. 1916.

≡ *Uleoporthe orbiculata* (Syd. & P. Syd.) Petr., Ann. Mycol. 39: 279. 1941.

≡ *Phylloporthe orbiculata* (Syd. & P. Syd.) E. Müller *apud* E. Müller & Arx, Beitr. Kryptogamenfl. Schweiz 11: 775. 1962.

This fungus was originally described as having hyaline ascospores with a medium septum. Müller and von Arx (1962) considered *Uleoporthe* Petr. to be a synonym of *Phylloporthe* Syd. & P. Syd. On the other hand, Barr (1978) separated the two genera on the basis of the stromatic tissues: prosenchymatous in the former and pseudoparenchymatous in the latter.

parmularia (*Valsaria*) (Berk.) Sacc., Syll. Fung. I, p. 744. 1882.

≡ *Valsa parmularia* Berk., J. Bot. (Hooker) 3: 19. 1851.

≡ *Pseudovalsa parmularia* (Berk.) Cooke, Grevillea 14: 55. 1885.

The type at K was on loan during our study. It is possibly a

Massariovalsa Sacc.

peckii (*Valsaria*) (Howe) Sacc. ≡ *Valsa peckii* Howe ≡ *Pseudovalsa peckii* (Howe) Cooke ≡ * *Pseudovalsaria peckii* (Howe) Barr

penicillariae (*Myrmaecium*) Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 26: 123. 1912.

It was originally described as having hyaline ascospores. It is probably not a *Valsaria*. We were unable to locate the type at LPS.

periplocae (*Valsaria*) (De Not.) Ces. & De Not. ≡ *Sphaeria periplocae* De Not. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

petrakii (*Valsaria*) Spooner ≡ * *Pseudothyridaria insitiva* Petr.

pezizaeformis (*Phaeocreopsis*) Boedijn, Bull. Jard. Bot. Buitenz., ser. II, 16: 371. 1940.

≡ *Hypocreopsis peziziformis* (Boedijn) Rifai, Reinwardtia 7: 574. 1969.

According to G. J. Samuels and A. Rossman (pers. comm.), this fungus does not seem to be a *Hypocreopsis* P. Karst. but has some similarity to *Sarawakus* C. G. Lloyd. They questioned whether it is hypocrealean because of the brown ascospores described in the protologue.

phlyctaenodes (*Valsaria*) (Mont.) Sacc. = *Sphaeria phlyctaenodes* Mont. = *Valsa phlyctaenodes* (Mont.) Mont. = *Pseudovalsa phlyctaenodes* (Berk.) Cooke = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

phoradendri (*Valsaria*) (Berk. & M. A. Curtis) Berl. & Voglino, Add. Syll. Fung., p. 130. 1886.

= *Melogramma phoradendri* Berk. & M. A. Curtis ex Cooke, Grevillea 13: 103. 1885.

= *Sphaeria phoradendri* Berk. & M. A. Curtis, *ined.*

U.S.A.: South Carolina, Society Hill, 6.1847, Curtis, M.A. 1114, corticated twigs of *Phoradendron*, as *Sphaeria phoradendri* B. & C., *ined.* (FH, TYPE of *Melogramma phoradendri*).

This fungus belongs to the Dothideaceae and is assignable to *Auerswaldia* Sacc. Cooke (1885a) reported that the ascospores are uniseptate. The type at FH has aseptate ascospores only.

pseudohypoxylon (*Valsaria*) Speg. = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

purpurascens (*Valsaria*) (DC. & Lam.) Sacc., Syll. Fung. I, p. 747. 1882.

= *Sphaeria purpurascens* DC. & Lam., Fl. Franç. II, p. 118. 1805.

= *Valsa purpurascens* (DC. & Lam.) P. L. Crouan & H. Crouan, Fl. Finist., p. 32. 1867.

= *Pseudovalsa purpurascens* (DC. & Lam.) Cooke, Grevillea 14: 55. 1885.

No material of this fungus was located at G.

purpurea (*Valsaria*) Peck = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

pustulans (*Valsaria*) (Ellis & Everh.) Sacc. *non* Rehm = *Diatrype pustulans*

Ellis & Everh. = * *Roussoella pustulans* (Ellis & Everh.) Y.-M. Ju, J. D. Rogers, & Huhndorf

pustulans (*Valsaria*) Rehm, Hedwigia 34: 164. 1895; *non* (Ellis & Everh.) Sacc., 1891.

See *Valsaria rehmii* Sacc. & Syd.

quadrata (*Diatrype*) Schwein. ex Berk. = *Myrmaecium quadratum*

(Schwein. ex Berk.) Rehm = *Valsaria quadrata* (Schwein. ex Berk.)

Sacc. = * *Valsaria fulvopruinata* (Berk.) Sacc.

rehmiana (*Valsaria*) S. Teng = *Hypoxylonopsis rehmiana* (S. Teng) S.

Teng = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

rehmii (*Valsaria*) Sacc. & Syd., Syll. Fung. XIV, p. 560. 1899.

= *Valsaria pustulans* Rehm, Hedwigia 34: 164. 1895; *non* (Ellis & Everh.) Sacc., 1891; [*nom. rejic.*, ICBN Art. 64.1].

SWITZERLAND: Käferberg und Uetliberg oberhalb Waldeck bei Zürich, 12.1893, Tavel, V., Rehm: Ascomyceten 1147, corticated wood (FH; S, SYNTYPES of *Valsaria pustulans* Rehm).

= * *Prosthecium appendiculatum* (Otth) Barr. See Wehmeyer (1941) for a description of this fungus.

reticulata (*Valsaria*) Kar & Maity = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

reticulata (*Valsonectria*) Loeffler & E. Müller = * *Valsaria rubricosa* (Fr.: Fr.) Sacc.

robiniae (*Valsaria*) (Schwein.: Fr.) Cooke = *Sphaeria robiniae* Schwein.: Fr. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

- * *rubricosa* (*Valsaria*) (Fr.: Fr.) Sacc. = *Sphaeria rubricosa* Fr.: Fr. = *Hypoxylon rubricosum* (Fr.: Fr.) Fr. = *Melogramma rubricosum* (Fr.: Fr.) Tul. & C. Tul. = *Myrmaecium rubricosum* (Fr.: Fr.) Fuckel
- rudis* (*Valsaria*) (P. Karst. & Har.) Theiss. & Syd. = *Dothidea rudis* P. Karst. & Har. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.
- saccardiana* (*Valsaria*) Speg. *apud* Sacc., *Michelia* 1: 393. 1879.
 = *Xylosphaeria saccardiana* (Speg.) Cooke, *Grevillea* 17: 86. 1889.
 = *Phaeosperma saccardianum* (Speg.) Traverso, *Fl. Ital. Crypt. I*, p. 293. 1906.

We could not locate the type at LPS. It may be at PAD. We have seen a specimen bearing *V. saccardiana* [FRANCE: Saintes (Charente-Inf.), Brunaud, P., Roumeguère's Fungi Gallici Exsiccati no. 3747, twigs of *Laurus nobilis*] from NY. It contains only a coelomycetous fungus.

- salicina* (*Valsaria*) Ellis & Everh. = * *Pseudovalsaria ferruginea* (Nitschke) Rappaz

- salvadorina* (*Valsaria*) Mundkur & Ahmad, *Mycol. Pap.* 18: 6. 1946. Fig. 5
 PAKISTAN: Sheikhupura, Ladhar, 13.9.1949, Ahmad, S., *Reliquiae Petrakianae* 882, bark of *Salvadora oleoides*, as *Valsaria salvadorina* (IMI 346463); near Hyderabad, 8.4.1964, Ahmad, S. 16903, bark of *Salvadora persica*, as *Valsaria salvadorina* (ZT).

We did not see the type. The cited specimens are not *Valsaria*. Stromata are pulvinate, coriaceous, constricted at base, 1-2 mm diam x 0.7-1 mm thick, with a pruinose, dull ochraceous brown surface and pale grayish brown interior. Ascomata are spherical, ca. 0.2 mm diam, with papillate, black ostioles. Asci are unitunicate, clavate, nearly sessile, without a visible apical apparatus, with eight ascospores arranged in a biseriate manner. Ascospores are two-celled, thick-walled, light brown, unconstricted to slightly constricted at septum, ellipsoid, with narrowly rounded ends, 21-29 x 9.5-12 µm, warted. Hamathecial tissue is paraphysate, sometimes dichotomously branched, 4-6 µm broad. In general, it fits the protologue except for the ascospores being light brown rather than dark brown to almost black. It should be noted that in the protologue no ornamentation was mentioned on ascospores. It may represent a new genus of Pyrenomycetes.

- sarothamni* (*Valsaria*) Auersw., *ined.*

= * *Diaporthe sarothamni* Nitschke, *Pyren. Germ.*, p. 303. 1867. *Fide* Wehmeyer (1933).

- sarraziniana* (*Valsaria*) Sacc. & Roum., *Rev. Mycol.* 5: pl. 39, fig. 8. 1883.

The type was not located at PAD. Its identity is uncertain.

- spartii* (*Valsaria*) Maubl. = ? *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.
- sphaerophora* (*Valsaria*) (Ellis & Everh.) Barr, *Stud. Mycol.* 31: 26. 1989.
 = *Didymosphaeria sphaerophora* Ellis & Everh., *Bull. Torrey Bot. Club* 22: 439. 1895.

MEXICO: Matamoras, 6.1885, Egeling, *Agave* (NY, HOLOTYPE of *Didymosphaeria sphaerophora*).

Barr (1989) transferred this fungus to *Valsaria*, but considered it to be a unitunicate fungus. However, this fungus has functionally bitunicate

asci. The hamathecial elements seem to be paraphysate. ***Valsaria sphaerophora*** may be a true ***Valsaria***, but further studies are needed to make a formal taxonomic decision.

spiculosa (Valsaria) Auersw., *ined.*

= * ***Diaporthe eres*** Nitschke. *Fide* Wehmeyer (1933).

spurca (Valsaria) Berk. & M. A. Curtis ex Cooke, *Grevillea* 20: 81. 1891.

= ***Sphaeria spurca*** Berk. & M. A. Curtis, *ined.*

U.S.A.: Massachusetts, 1856, Murray, D., sent by Sprague as no. 504 [= 5441], corticated wood, as ***Sphaeria spurca*** Berk. & M. A. Curtis, *ined.* (FH, TYPE of ***Valsaria spurca***).

= * ***Massariovalsa sudans*** (Berk. & M. A. Curtis) Sacc. See Barr (1978) for a description of this fungus.

squarrosa (Valsaria) Batista, *Bol. Agric., Pernambuco* 17: 62. 1950.

We did not receive a response on a request for the type from URM where the type is presumably deposited.

staphylina (Valsaria) Ellis & Everh., *Proc. Acad. Nat. Sci. Philadelphia* 1893: 144. 1893.

The type was not located at FH or NY. Its identity is uncertain.

stellata (Valsaria) Romell = ***Endoxylina stellulata*** (Romell) Romell = *

Endoxylina astroidea (Fr.: Fr.) Romell

streblii (Valsaria) Rehm, *Leafl. Philipp. Bot.* 6: 2270. 1914.

PHILIPPINES: Los Baños, 20.10.1913, Raimundo, M.B. 1859, dead twigs of ***Streblus*** (S, HOLOTYPE of ***Valsaria streblii***).

= * ***Macrovalsaria megalospora*** (Mont.) Sivanesan. See Sivanesan (1975) for a description of this fungus.

There are two other fungi mixed in the type: ***Valsaria insitiva*** and a ***Cryptovalsa*** Ces. & De Not. ex Fuckel.

subcoccodes (Valsaria) (Speg.) Batista *apud* Batista & Maia, *Revista Biol., Lisboa* 1: 327. 1958.

= ***Roussoella subcoccodes*** Speg., *Bol. Acad. Nac. Ci.* 11: 549. 1889.

= ***Pseudothis subcoccodes*** (Speg.) Theiss., *Ann. Mycol.* 16: 182. 1918.

BRAZIL: Sao Paulo, Apaihy, 5.1888, Puiggari, J. 2841, leaves of Leguminosae (LPS 366, HOLOTYPE of ***Roussoella subcoccodes***).

= * ***Pseudothis coccodes*** (Lév.) Theiss. & Syd., *Ann. Mycol.* 13: 565. 1915.

We agree with Müller and von Arx (1962) in synonymizing ***R. subcoccodes*** with ***Pseudothis coccodes***. The taxonomic position is not certain. It should be noted that ascospores of this fungus, like those of ***Thuemenella cubispora*** (Ellis & Holw.) Boedijn (Rogers, 1981; Samuels and Rossman, 1992), are cubic and have several longitudinal furrows. The septum of ***P. coccodes*** is formed at one-third ascospore length from one end. A ***Lasmeniella*** Petr. & Syd. was also found in the stromata of the type of ***Roussoella subcoccodes***.

subtropica (Valsaria) Speg., *Anales Mus. Nac. Hist. Nat. Buenos Aires* 19: 372. 1909.

ARGENTINA: Tucumán, 14.4.1906, Spegazzini, C., decaying culms of *Saccharum officinarum* (LPS 5999 [2 pks.], HOLOTYPE of *Valsaria subtropica*).

A synonym of *Valsaria clavatiasca* Speg.

syconophila (*Valsaria*) Schulzer = ? *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

symphoricarpi (*Valsaria*) (Ellis & Everh.) Theiss. & Syd., Ann. Mycol. 13: 327. 1915.

≡ *Plowrightia symphoricarpi* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 42: 249. 1890.

≡ *Gibbera andersonii* Shoemaker, Canad. J. Bot. 41: 1421. 1963.

≡ * *Dothidotthia andersonii* (Shoemaker) Barr, Mycotaxon 29: 503. 1987.

tamaricis (*Valsaria*) Mundkur & Ahmad, Mycol. Pap. 18: 7. 1946.

PAKISTAN: Rahim Yar Khan, 25.8.1964, decorticated wood of *Tamarix articulata*, as *Valsaria tamaricis* (ZT).

We have not seen the type. The cited specimen is an undoubted *Valsaria*. It shares most characteristics with *V. insitiva* except for having smaller, more light-colored ascospores, 12-14 x 6-7 µm.

theissenii (*Valsaria*) Rehm, Ann. Mycol. 7: 537. 1909.

BRAZIL: São Leopoldo, 1908, Theissen, F. 96, corticated wood (S, HOLOTYPE of *Valsaria theissenii*).

= * *Immotthia atrograna* (Cooke & Ellis) Barr. See Barr (1993) for a description of this fungus.

thelebola (*Valsaria*) (Fr.: Fr.) J. Schröt. *apud* Cohn, Kryptog.-Fl. Schles. III, p. 440. 1897.

≡ *Sphaeria thelebola* Fr.: Fr., Syst. Mycol. II, p. 408. 1823.

≡ *Valsa thelebola* (Fr.: Fr.) Fr., Summa Veg. Scand. II, p. 412. 1849.

≡ *Aglaospora thelebola* (Fr.: Fr.) Tul. & C. Tul., Sel. Fung. Carp. II, p. 166. 1863.

≡ *Diaportha thelebola* (Fr.: Fr.) Sacc., Myc. Ven. no. 224. 1875.

≡ * *Melanconis thelebola* (Fr.: Fr.) Sacc., Syll. Fung. I, p. 605. 1882. *Fide* Wehmeyer (1941).

≡ *Taleola thelebola* (Fr.: Fr.) Nitschke ex Rehm, Ann. Mycol. 4: 479. 1906.

≡ *Pseudovalsella thelebola* (Fr.: Fr.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Cl., Abt. 1, 126: 393. 1917.

tiliae (*Valsaria*) (Pers.: Fr.) De Not., Sfer. Ital., p. 58. 1863.

≡ *Sphaeria tiliae* Pers., Syn. Meth. Fung., p. 84. 1801; Pers.: Fr., Syst. Mycol. II, p. 485. 1823.

≡ * *Hercospora tiliae* (Pers.: Fr.) Fr., Syst. Orb., p. 119. 1825. *Fide* Barr (1978) and see therein for additional synonyms.

toxici (*Valsaria*) (Schwein.) Sacc., Syll. Fung. I, p. 746. 1882.

≡ *Sphaeria toxici* Schwein., Trans. Amer. Philos. Soc., n. ser., 4: 200. 1832.

≡ *Valsa toxici* (Schwein.) Berk., Grevillea 4: 99. 1876.

U.S.A.: North Carolina, Salem and Pennsylvania, Bethlehem, Syn. 1330, corticated branches (PH, HOLOTYPE of *Sphaeria toxicī*); Pennsylvania, Bethlehem, Syn. 1330, Collins Coll. 114, corticated branches, as *Sphaeria toxicī* (PH).

An *Eutypella* (Nitschke) Sacc., as suggested by Spielman (1985).
tubaraoensis (*Valsaria*) (Henn.) Theiss. & Syd., Ann. Mycol. 12: 273. 1914.
 ≡ *Dothidea tubaraoensis* Henn., Hedwigia 43: 88. 1904.

The type was not located at S. Its identity is uncertain.

viticola (*Valsaria*) (Schwein. ex Berk.) Sacc. ≡ *Diatrype viticola* Schwein. ex Berk. non *Sphaeria viticola* Schwein. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

xanthoxyli (*Valsaria*) Ellis & Everh. = * *Valsaria insitiva* (Tode: Fr.) Ces. & De Not.

APPENDIX

There are some additional names for which we have not conducted a search for type or authentic materials. They are listed as follow.

ampelina (*Valsaria*) Aversa-Sacca, Bol. Agric. (São Paulo) 23: 330. 1922.

arxii (*Valsaria*) Patwardhan & Joshi *apud* Joshi & Patwardhan, Botanique, Nagpur 3: 45. 1972; as "*arxi*".

ficophila (*Valsaria*) Schulzer, Verh. K. K. Zool.-Bot. Ges. Wien 20: 652. 1870.

lophiostoma (*Valsaria*) (Hazsl.) Sacc., Syll. Fung. I, p. 750. 1882.

≡ ? *Myrmaecium lophiostomum* Hazsl., Hedwigia 13: 142. 1874.

manihotis (*Valsaria*) Chevaugéon, Encycl. Mycol. 28: 47. 1956.

microspora (*Valsaria*) Rostr., Skr. Vidensk.-Selsk. Christiana, Math.-Naturvidensk. Kl. 4: 23. 1904.

milletiae (*Valsaria*) (Racib.) Sacc. & Trott., Syll. Fung. XXII, p. 390. 1913.

≡ ? *Myrmaecium milletiae* Racib., Bull. Int. Acad. Sci. Cracovie, Cl. Sci. Math. 1909: 391. 1909.

neurospora (*Valsaria*) Munk *apud* Möller, Fung. Faeröes II, p. 77. 1958.

ribicola (*Valsaria*) Naumov, Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk SSSR 7: 110. 1951.

rubricosa (*Valsaria*) (Fr.: Fr.) Sacc. var. *cydoniae* (Schulzer) Sacc. & Traverso *apud* Sacc., Syll. Fung. XX, p. 1120. 1911.

≡ *Melogramma* ? Schulzer, Verh. K. K. Zool.-Bot. Ges. Wien, tab. 13, fig. 26. 1871.

striispora (*Valsaria*) Saccas, Bull. IFCC 16: 480. 1981; [*nom. inval.*, ICBN Art. 37.1].

ACKNOWLEDGEMENTS

PPNS no. 0223, Department of Plant Pathology, Project 1767, Washington State University, College of Agriculture and Home Economics, Pullman, Washington. This study was supported in part by National Science Foundation grant BSR-9017920 to JDR. We thank herbaria B, BPI, FH, H,

HBG, IMI, LPS, MA, NY, NYS, PAD, PC, PREM, RO, S, UPS, W, and ZT for loaning specimens and searching for material. We thank Michael J. Adams and Lori Carris, Washington State University, for aid with electron microscopy and photography and for reviewing the manuscript, respectively. We thank Brenda E. Callan, Victoria, B.C., Canada, for reviewing the manuscript. We thank Donald P. Rogers, Auburn, Washington, for checking the Latin descriptions. We thank Gary J. Samuels, BPI, for data on type materials, Åke Strid, S, for measuring ascospores of a specimen, and Wendy A. Untereiner, Toronto, Canada, for suggesting the disposition of an anamorph.

LITERATURE CITED

- Aptroot, A. 1995a. Redisposition of some species excluded from *Didymosphaeria* (Ascomycotina). *Nova Hedwigia* 60: 325-379.
- Aptroot, A. 1995b. A monograph of *Didymosphaeria*. *Stud. Mycol.* 37: 1-160.
- Barr, M. E. 1978. The Diaporthales in North America with emphasis on *Gnomonia* and its segregates. *Mycol. Mem.* 7: 1-232.
- Barr, M. E. 1983. Muriform ascospores in Ascomycetes. *Mycotaxon* 18: 149-157.
- Barr, M. E. 1984. *Herpotrichia* and its segregates. *Mycotaxon* 20: 1-38.
- Barr, M. E. 1987. Prodrum to class Loculoascomycetes. Published by the author, Amherst, Massachusetts. 168 p.
- Barr, M. E. 1989. Some unitunicate taxa excluded from *Didymosphaeria*. *Stud. Mycol.* 31: 23-27.
- Barr, M. E. 1990a. Prodrum to nonlichenized, pyrenomycetous members of class Hymenoascomycetes. *Mycotaxon* 39: 43-184.
- Barr, M. E. 1990b. Melanommatales (Loculoascomycetes). *N. Amer. Fl.* 2: 1-129.
- Barr, M. E. 1993. Redisposition of some taxa described by J. B. Ellis. *Mycotaxon* 46: 45-76.
- Barr, M. E. 1994. Notes on the Amphisphaeriaceae and related families. *Mycotaxon* 51: 191-224.
- Barr, M. E., C. T. Rogerson, S. J. Smith, and J. H. Haines. 1986. An annotated catalog of the Pyrenomycetes described by Charles H. Peck. *New York State Mus. Bull.* 459: 1-74.

- Berkeley, M. J. 1876. Notices of North American fungi. *Grevillea* 4: 93-108.
- Candoussau, F., K. Katumoto, and M. Sherwood-Pike. 1985. Bambusicolous fungi from the Southwest of France I. Two new species of Pyrenomyces and a new genus of the Phacidiaceae. *Sydowia* 38: 28-34.
- Cesati, V., and G. De Notaris. 1863. Schema di classificazione degli Sferiacei Italici aschigeri. *Comment. Soc. Crittog. Ital.* 1: 177-240.
- Clements, F. E., and C. L. Shear. 1931. The genera of fungi. H. W. Wilson Co., New York. 227 p.
- Cooke, M. C. 1885a. Synopsis Pyrenomycetum. *Grevillea* 13: 100-109.
- Cooke, M. C. 1885b. Synopsis Pyrenomycetum. *Grevillea* 14: 14-17.
- Currey, F. 1858. Synopsis of the fructification of the compound Sphaeriae of the Hookerian herbarium. *Trans. Linn. Soc. London* 22: 257.
- Dennis, R. W. G. 1960. British cup fungi and their allies. An introduction to the Ascomycetes. Ray Society, London. 280 p.
- Dennis, R. W. G. 1978. British Ascomycetes. J. Cramer. 585 p.
- Eriksson, O. E., and J.-Z. Yue. 1989. An amended description and disposition of the genus *Thyridium*. *Systema Ascomycetum* 8: 9-16.
- Farr, D. F., G. F. Bills, G. P. Chamuris, and A. Y. Rossman. 1989. Fungi on plants and plant products in the United States. APS Press, St. Paul, Minnesota. 1252 p.
- Fuckel, L. 1869-70. Symbolae Mycologicae. *Jahrb. Nassauischen Vereins Naturk.* 23-24: 1-459.
- Glawe, D. A. 1985. The pleomorphic asexual state of *Valsaria insitiva* in artificial culture. *Mycologia* 77: 62-71.
- Greuter, W. et al. 1994. International code of botanical nomenclature (Tokyo code). *Regnum Vegetabile* Vol. 131. Koeltz Scientific Books, Königstein, Germany. 389 p.
- Hawksworth, D. L. 1974. Mycologist's handbook. Commonwealth Mycological Institute, Kew, Surrey, England. 231 p.
- Hawksworth, D. L. 1993. Name changes for purely nomenclatural reasons are now avoidable. *Systema Ascomycetum* 12: 1-6.

- Hawksworth, D. L., B. C. Sutton, and G. C. Ainsworth. 1983. Dictionary of the fungi. 7th ed. Commonwealth Mycological Institute, Kew, Surrey. 445 p.
- Hino, I, and K. Katumoto. 1955. Illustrationes fungorum bambusicolorum. III. Bull. Fac. Agric. Yamaguti Univ. 6: 29-68.
- Hino, I, and K. Katumoto. 1956. Illustrationes fungorum bambusicolorum. IV. Bull. Fac. Agric. Yamaguti Univ. 7: 267-274.
- Hoog, G. S. De, and M. R. McGinnis. 1987. Ascomycetous black yeasts. Stud. Mycol. 30: 187-199.
- Höhnelt, F. von. 1924. Beitrag zur Mikromycetenflora von Java. Bull. Jard. Bot. Buitenzorg III, 6: 1-8.
- Huhndorf, S. M. 1992a. Neotropical Ascomycetes 1. *Valsonectria cinnamomi* in artificial culture. Mycologia 84: 642-649.
- Huhndorf, S. M. 1992b. Neotropical Ascomycetes 2. *Hypsostroma*, a new genus from the Dominican Republic and Venezuela. Mycologia 84: 750-758.
- Ju, Y.-M., and J. D. Rogers. 1994. Biological and developmental studies of *Xylobotryum andinum* (Ascomycetes, Loculoascomycetes). Cryptog. Bot. 4: 346-355.
- Ju, Y.-M., F. San Martín, and J. D. Rogers. 1993. Three xylariaceous fungi with scolecosporous conidia. Mycotaxon 47: 219-228.
- Kale, S. B. 1970. The genus *Valsaria* in India. Sydowia 23: 194-197.
- Kar, A. K., and M. K. Maity. 1979. The Pyrenomycetes of West Bengal (India) - VII. Indian Phytopath. 32: 425-433.
- Kenerley, C. M., and J. D. Rogers. 1976. On *Hypoxylon serpens* in culture. Mycologia 68: 688-691.
- Kobayashi, T. 1970. Taxonomic studies of Japanese Diaporthaceae with special reference to their life-histories. Bull. Gov. Forest. Exp. Sta. 226: 1-242.
- Kobayasi, Y., and Y. Doi. 1969. On *Phaeocreopsis hypoxyloides* (Speg.) Sacc. et Syd. Mem. Nat. Sci. Mus. Tokyo 2: 51-56.
- Leuchtmann, A., and E. Müller. 1986. Über *Thyridium vestitum* und sein Anamorph (Ascomycetes). Bot. Helvetica 96: 283-287.

- Lindau, G. 1897. Pyrenomycetinae. In: A. Engler and K. Prantl, Eds. Die natürlichen Pflanzenfamilien 1: 321-491.
- Miller, J. H. 1949. A revision of the classification of the Ascomycetes with special emphasis on the Pyrenomycetes. *Mycologia* 41: 99-127.
- Müller, E., and J. A. von Arx. 1962. Die Gattungen der didymosporen Pyrenomyceten. *Beitr. Kryptogamenfl. Schweiz* 11: 1-922.
- Müller, E., and J. A. von Arx. 1973. Pyrenomycetes: Meliolales, Coronophorales, Sphaeriales. In: G. C. Ainsworth, F. K. Sparrow, and A. S. Sussman, Eds. The fungi IVA. Academic Press, New York and London. p. 87-132.
- Munk, A. 1953. The system of the Pyrenomycetes. *Dansk Bot. Ark.* 15: 1-163.
- Munk, A. 1957. Danish Pyrenomycetes. A preliminary flora. Ejnar Munksgaard, Copenhagen. 491 p.
- Notaris, G. De. 1853. Micromycetes Italici novi vel minus cogniti VII. *Mem. Reale Accad. Sci. Torino*, ser. II, 13: ?.
- Penzig, O., and P. A. Saccardo. 1904. *Icones fungorum Javanicorum*. E. J. Brill, Leiden. 124 p. + 80 plates.
- Petrak, F. 1927. Mykologische notizen IX. *Ann. Mycol.* 25: 193-343.
- Petrak, F., and H. Sydow. 1927. Die Gattungen der Pyrenomyzeten, Sphaeropsideen und Melanconieen. *Beih. Rep. Spec. Nov. Regni Veg.* 42: 1-551.
- Petrak, F., and H. Sydow. 1936. Kritisch-systematische Originaluntersuchungen über Pyrenomyzeten, Sphaeropsideen und Melanconieen. *Ann. Mycol.* 34: 11-52.
- Rappaz, F. 1987. Taxonomie et nomenclature des Diatrypacées à asques octosporés. *Mycol. Helvetica* 2: 285-648.
- Rappaz, F. 1995. *Anthostomella* and related xylariaceous fungi on hard wood from Europe and North America. *Mycol. Helvetica* 7: 99-168.
- Rehm, H. 1914. Ascomycetes Philippinenses. V. *Leafl. Philipp. Bot.* 6: 2191-2237.
- Rogers, J. D. 1975. *Hypoxylon serpens*: cytology and taxonomic considerations. *Canad. J. Bot.* 53: 52-55.

- Rogers, J. D. 1981. *Sarcoxylon* and *Entonaema* (Xylariaceae). *Mycologia* 73: 28-61.
- Rogers, J. D., J. Stone, and Y.-M. Ju. 1994. *Anthostomella formosa* var. *abietis* var. nov. and notes on *Apiorhynchostoma*. *Mycologia* 86: 700-703.
- Rogerson, C. T. 1970. The hypocrealean fungi (Ascomycetes, Hypocreales). *Mycologia* 62: 865-910.
- Saccardo, P. A. 1882. *Sylloge Fungorum* I. Patavii. 768 p.
- Saccardo, P. A. 1926. *Sylloge Fungorum* XXIV, Set. I. Abellini. 703 p.
- Samuels, G. J., and C. T. Rogerson. 1984. *Nectria atrofusca* and its anamorph, *Fusarium staphyleae*, a parasite of *Staphylea trifolia* in eastern North America. *Brittonia* 36: 81-85.
- Samuels, G. J., and A. Y. Rossman. 1992. *Thuemenella* and *Sarawakus*. *Mycologia* 84: 26-40.
- Shear, C. L. 1939. Mycological notes. III. *Mycologia* 31: 322-336.
- Shear, C. L. 1946. Mycological notes. VIII. *Mycologia* 38: 664-673.
- Sivanesan, A. 1975. Redisposition and descriptions of some *Amphisphaeria* species and a note on *Macrovalsaria*. *Trans. Brit. Mycol. Soc.* 65: 395-402.
- Spielman, L. J. 1985. A monograph of *Valsa* on hardwoods in North America. *Canad. J. Bot.* 63: 1355-1378.
- Spooner, B. M. 1986. New or rare British microfungi from Esher Common, Surrey. *Trans. Brit. Mycol. Soc.* 86: 401-408.
- Stevens, N. E. 1933. Two apple black rot fungi in the United States. *Mycologia* 25: 536-548.
- Sutton, B. C. 1980. The Coelomycetes. Fungi Imperfecti with pycnidia, acervuli and stromata. Commonwealth Mycological Institute, Kew, Surrey, England. 696 p.
- Theissen, F., and H. Sydow. 1915. Die Dothideales. *Ann. Mycol.* 13: 149-430.
- Tode, H. J. 1791. *Fungi mecklenburgenses selecti* II. *Luneburgi*. 64 p.

- Traverso, G. B. 1906. Flora Italica Cryptogama Pars I. Fungi Pyrenomycetae. Fasc. 1: 1-352.
- Tulasne, L.-R., and C. Tulasne. 1863. Selecta Fungorum Carpologia II. Paris. 319 p.
- Untereiner, W. A. 1993. A taxonomic revision of the genus *Endoxyla*. Mycologia 85: 294-310.
- Wehmeyer, L. E. 1923. The imperfect stage of some higher Pyrenomycetes obtained in culture. Pap. Michigan Acad. Sci. 3: 245-266.
- Wehmeyer, L. E. 1926. A biologic and phylogenetic study of the stromatic Sphaeriales. Amer. J. Bot. 13: 575-645.
- Wehmeyer, L. E. 1933. The genus *Diaporthe* Nitschke and its segregates. Univ. Michigan Stud. Sci. Ser. 9: 1-349.
- Wehmeyer, L. E. 1941. A revision of *Melanconis*, *Pseudovalsa*, *Prosthecium*, and *Titania*. Univ. Michigan Stud. Sci. Ser. 14: 1-161.
- Wehmeyer, L. E. 1975. The pyrenomycetous fungi. Mycol. Mem. 6: 1-250.

FIGURE LEGENDS

Figs. 1-12. *Valsaria* species. 1. *V. insitiva*. Ascospore, X1240. 2 and 3. *V. fulvopruinata*. Ascospores, Fig. 2, X1240, Fig. 3, X1300. 4. *V. rubricosa*. Ascospore, X1300. 5. *V. salvadorina*. Ascospore ornamentation, X1300. 6. *V. rubricosa*. Immature ascus apex, X1300. 7. *V. fulvopruinata*. Germinated ascospore, X1300. 8. *V. fulvopruinata*. Immature ascus apex, X1500. 9. *V. insitiva*. Immature ascus apex, X1000. 10. *V. bambusae*. Ascus apex, X3000. 11 and 12. *V. insitiva*. Ascus apices. Apex in fig. 11 is an optical section, X3000; apex in fig. 12 is face view of the opening, X3000.

Figs. 1-9 by differential interference contrast microscopy of material mounted in water. Figs. 10-12 by dark field fluorescence microscopy of material mounted in Calcofluor PMW white aqueous solution. Figs. 1, 9, 11, and 12 from J. D. Rogers, France (JDR). Figs 2 and 7 from M. E. Barr 6905 (NY). Figs. 3 and 8 from R. F. Cain (WSP 45605). Fig. 4 from Y.-M. Ju 73092401 (JDR). Fig. 5 from S. Ahmad 16903 (ZT). Fig. 6 from D. M. Vital & W. R. Buck 20342 (NY). Fig. 10 from IMI 333847.

Figs. 13-16. *Valsaria* species. 13. *V. insitiva*. Ascospore, X4900. 14. *V. rubricosa*. Ascospore, X5000. 15. *V. fulvopruinata*. Ascospore, X5000. 16. *V. bambusae*. Ascospore, X4000.

All figures from scanning electron microscopy. Fig. 13 from C. L. Shear (WSP). Fig. 14 from Y.-M. Ju 73092401 (JDR). Fig. 15 from R. F. Cain (WSP 45605). Fig. 16 from IMI 333847.

Figs. 17-22. *Roussoella* species. Figs. 17-20. *R. hysterioides*. Ascospores showing variation in morphology and surface ornamentation from various collections; fig. 17, X4000, other figs. X3500. Fig. 21. *R. pustulans*. Ascospore, X8000. Fig. 22. *R. intermedia*. Ascospore, X5000.

All figures by scanning electron microscopy. Fig. 17 from F. Candoussau 289 (JDR). Fig. 18 from Y.-M. Ju 76090508 (JDR). Fig. 19 from Java, Indonesia (FH). Fig. 20 from Y.-M. Ju 77010730 (JDR). Fig. 21 from Y.-M. Ju 77010731 (JDR). Fig. 22 from holotype.

Figs. 23-27. *Roussoella* species. 23. *R. alveolata*. Ascospore, X2200. 24. *R. scabrispora*. Ascospore, X3000. 25. *R. chilensis*. Ascospore, X3000. 26. *R. sp.* Ascospore, X3500. 27. *R. donacicola*. Ascospore ornamentation, X10,000.

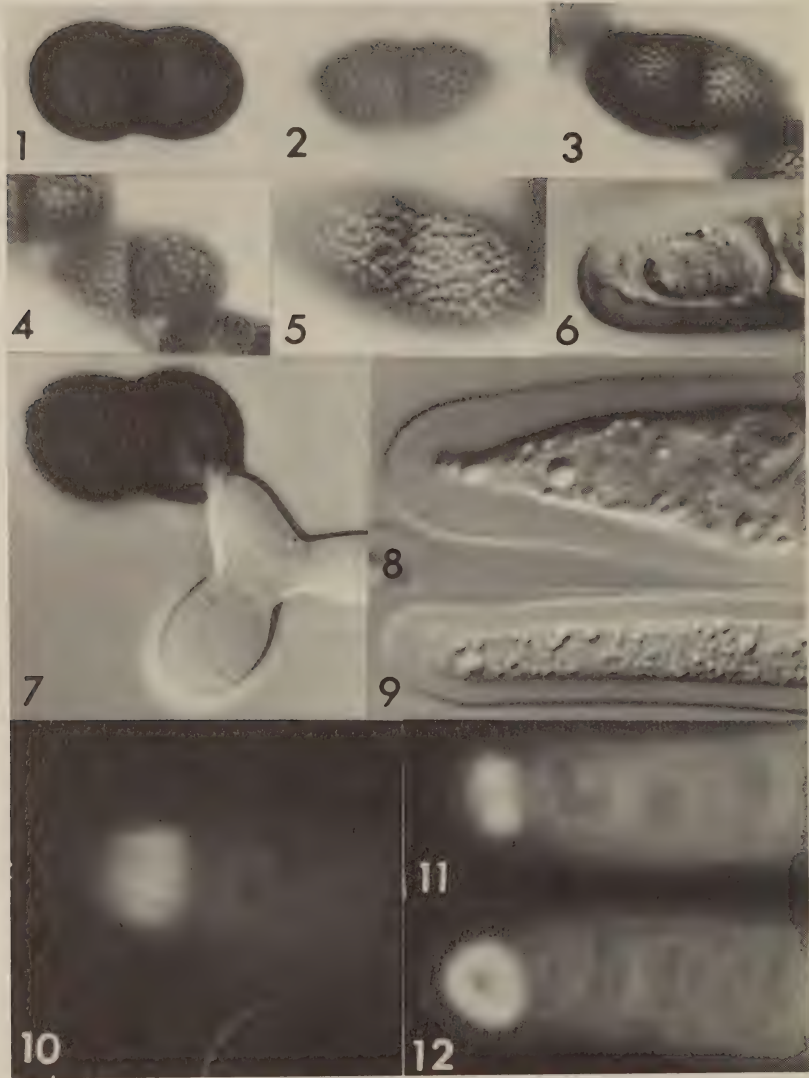
All figures by scanning electron microscopy. Fig. 23 from holotype. Fig. 24 from holotype. Fig. 25 from holotype. Fig. 26 from J. D. Rogers (JDR). Fig. 27 from holotype.

Figs. 28-32. Conidia of *Roussoella hysterioides* anamorph. 28. Conidium. Areas of outer wall formation or attachment (arrows). 29 and 30. Conidia. Arrows mark regions where outer wall material is being generated by inner wall judging from the thickness of unseparated areas. 31. Surface morphology of conidia. Blisters correspond to discontinuous separation of inner and outer walls shown in figs. 28-30. 32. Conidium with broken outer wall. Inner wall visible through break (arrow).

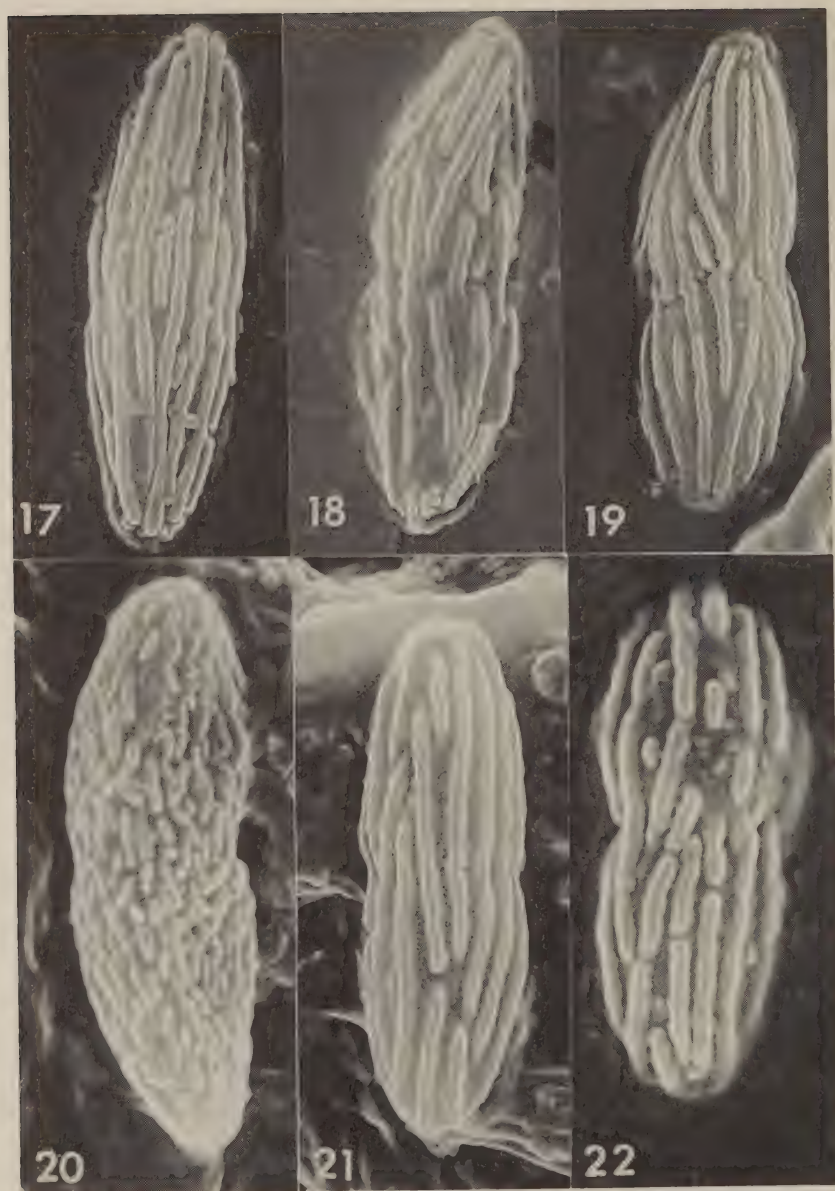
Figs. 28-30 from transmission electron microscopy. Sections stained with lead citrate. Figs. 31 and 32 by scanning electron microscopy. Fig. 31, X6,000; Figs. 30 and 32, X7,000; Fig. 29, X8,000; Fig. 28, X10,500.

Figs. 33-35. Anamorphs of *Valsaria bambusae*, *V. fulvopruinata*, and *Roussoella hysterioides*. 33. *V. bambusae*. A. Blastoconidia from vegetative hyphae. B. Vegetative hypha bearing a young blastoconidium and several conidial secession scars. C and D. Aged vegetative hyphae becoming inflated and disarticulated. E and F. Phialoconidia and conidiophores from conidiomatal locules. G and H. Blastoconidia and conidiophores from conidiomatal locules. 34. *V. fulvopruinata*. A and B. Conidiophores and phialoconidia from conidiomatal locules. C. Aged vegetative hypha becoming inflated and disarticulated. D. Vegetative hypha bearing a young blastoconidium and several conidial secession scars. E. Blastoconidia from vegetative hyphae. 35. *R. hysterioides*. A. Conidiophores. B. Conidia.

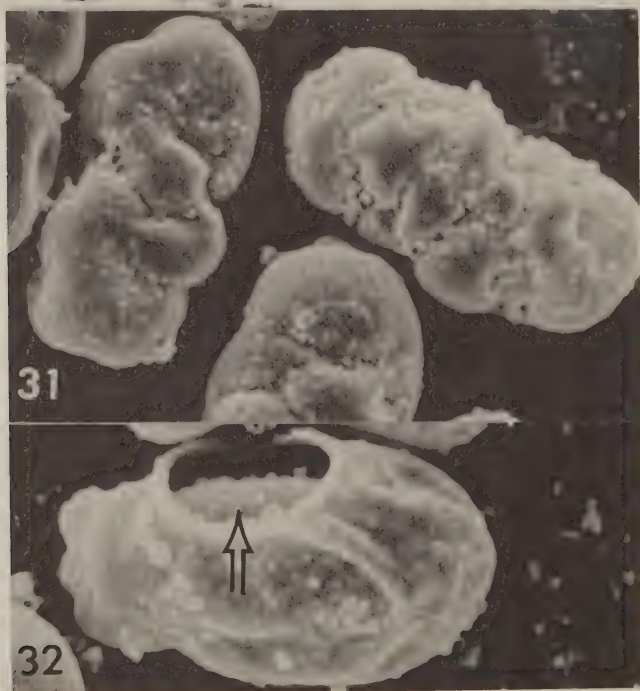
The scale bar represents 10 μm .

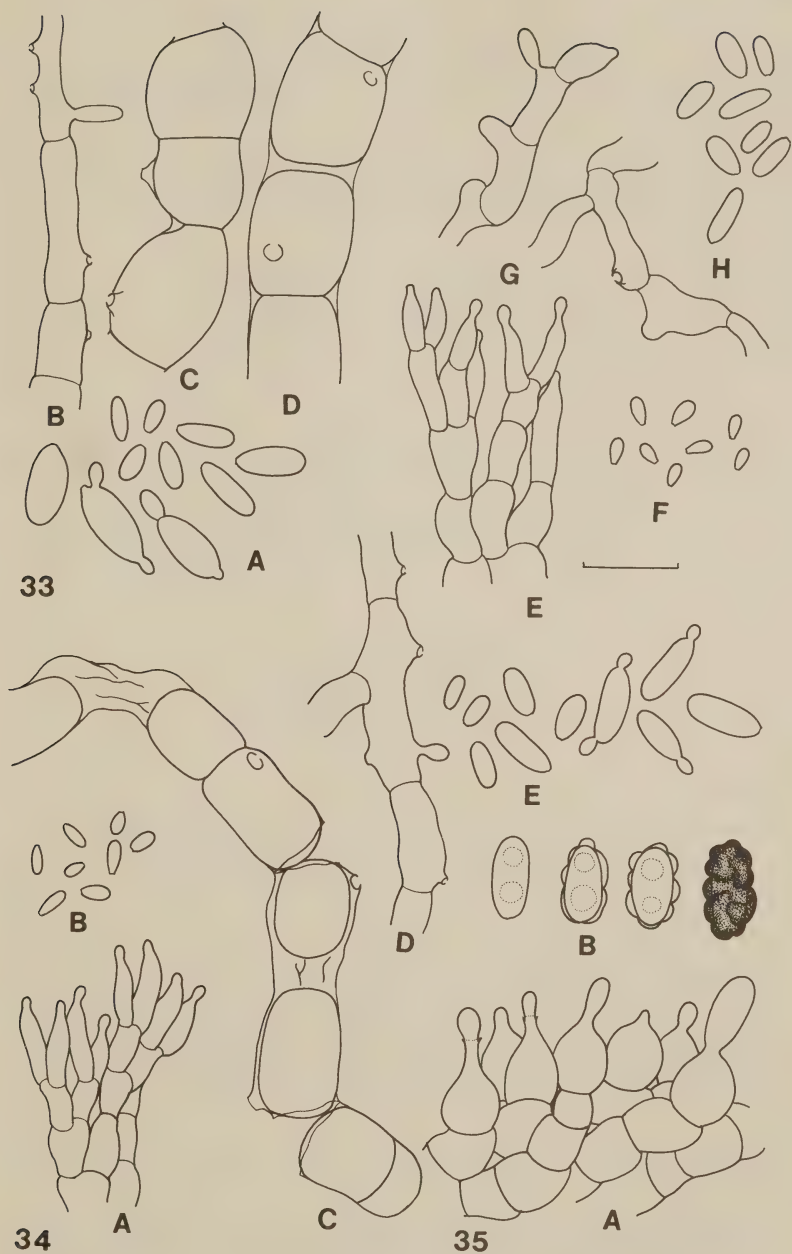












MEXICAN FUNGI: *XYLARIA ENTOSULPHUREA* SP. NOV. AND
NEOTYPIFICATION OF *ENTONAEMA GLOBOSUM*

Jack D. Rogers
Department of Plant Pathology
Washington State University
Pullman, Washington 99164-6430

and

Felipe San Martín
Instituto Tecnológico de Ciudad Victoria
Blvd. Emilio Portes Gil y Ave. Zeferino Fajardo
Apartado Postal no. 175
87010 Cd. Victoria, Tamaulipas, MEXICO

and

Yu-Ming Ju
Department of Plant Pathology
Washington State University
Pullman, Washington 99164-6430

ABSTRACT

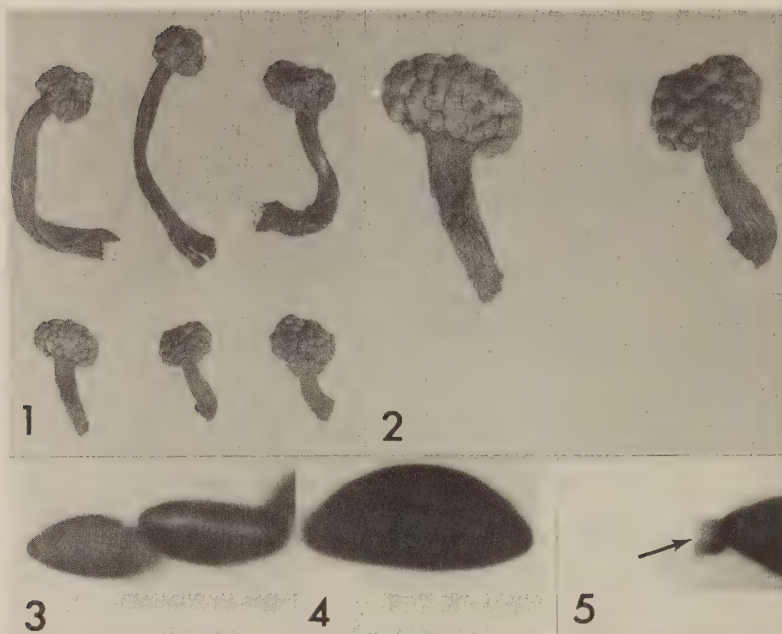
Xylaria entosulphurea, a taxon with gross features of *Podosordaria* and a *Geniculosporium*-like anamorph, is described as new. *Entonaema globosum*, originally described from Mexican material, is neotypified.

Key words: *Entonaema*, *Geniculosporium*, *Podosordaria*, *Xylaria*

One of us (FSM) collected a xylariaceous fungus from decaying wood and the roots of *Eugenia capuli* (Schl. & Cham.) Berg. The fungus resembles a *Podosordaria* Ellis & Holw. and, indeed, we suspected it to be of that genus. The anamorph, however, is of the *Xylaria* type (Rogers, 1985; Rogers et al., 1992; Rogers and Laessøe, 1992) and it is thus described as a *Xylaria*.

Xylaria entosulphurea J. D. Rogers, F. San Martín, et Y.-M. Ju Figs. 1-5

Capitula stromatum subrotunda, peritheciis numerosis cum tumulis conspicuis praedita, usque ad 4 mm diam x 3 mm crassa, stipitibus nervatis usque ad 2 cm longitudine x 1 mm diam, extus brunnea cum ostioliis atris, intus sulphurea perithecia cingentia, pigmento luteo in KOH dissoluto;



Figs. 1-5. *Xylaria entosulphurea*. 1. Stromata, X2.5. 2. Stromata, X5. 3. Ascospores, one of which shows germ slit, X1650. 4. Ascospores, X2200. 5. Ascus apical ring (arrow), X1500.

substantia sub peritheciis alba. Textura mollis. Perithecia 0.3-0.5 mm diam. Ostiola papillata. Asci octospori, cylindrici, stipitati, 90-150 μ m longitudine tota x 5-7 μ m crassi, partibus sporiferis 71-88 μ m longitudine, annulo apicali in liquore iodato Melzeri cyanescente, cuboideo vel cuneato, 1.5-3 μ m alto x 2-3 μ m crasso. Paraphyses ca. 2 μ m diam, copiosae. Ascosporae brunneae, unicellulares, ellipsoideo-inequilaterales, leves, (10-) 12-13.5 x (5-) 6-6.5 μ m, rima germinativa recta ventrali longa in latitudine conspicua praeditae. Status agamicus in culturis ad *Geniculosporium* pertinet.

Stromatal heads subglobose provided with numerous perithecia with conspicuous elevations, up to 4 mm diam x 3 mm thick, with ribbed stipe up to 2 cm long x 1 mm diam, externally brown with black ostioles, internally sulfur yellow surrounding perithecia, with yellow pigment bleeding out in 10% KOH; white beneath perithecia. Texture soft. Perithecia 0.3-0.5 mm diam. Ostioles papillate. Asci 8-spored, cylindrical, stipitate, 90-150 μ m total length x 5-7 μ m broad, with spore-bearing part 71-88 μ m long, with apical ring bluing in Melzer's iodine reagent, cuboid to cuneate, 1.5-3 μ m high x 2-3 μ m broad. Paraphyses ca. 2 μ m diam, numerous. Ascospores brown, unicellular, ellipsoid-inequilateral, smooth, (10-) 12-13.5 x (5-) 6-6.5 μ m, with conspicuously broad germ slit spore-length on ventral side. Anamorph in culture *Geniculosporium*-like.

SPECIMENS EXAMINED: MEXICO: Tamaulipas State, El Cielo Biosphere Reserve, Gómez Farias Municipality, San Jose Ejido, on primary roots of *Eugenia capuli* (Schl. & Cham.) Berg., 4.X.1994, San Martín, P. 1526 (WSP 69646, HOLOTYPE), CULTURED; Tamaulipas State, Rancho "El Cielo", Gómez Farias municipality, on decayed wood, 8.VII.1987, San Martín, F. 206 (ITCV; WSP); Michoacán State, Pátzcuaro municipality, on wood in cloud forest, sine anno, Díaz-Barriga 773 (ITCV); Morelos State, 5 km W Tepoztlán, on wood in tropical forest with abundant *Quercus* spp., IX.1967, Quiroz 57 (XAL).

Culture and anamorphic state of *X. entosulphurea*

Colonies on 2% Difco oat meal agar at ca. 20°C under fluorescent light growing slowly, ca. 5 cm diam after 2 wk, appressed, zonate, the older (inner) zone deep tawny, the younger (outer) zone grayish yellow or pale yellow. Radial veins or wrinkles arising from which synnemata produced. Synnemata first formed after 3 wk, white, long conical, ca. 1.5 mm long x 1 mm diam at base, bearing long, loose irregularly branched conidiophores ca. 100 x 4 µm, ultimately bearing conidiogenous cells 17-30 x 3-4 µm, producing conidia holoblastically, proliferating by fine geniculations. Conidia hyaline, smooth, oblong to long obovoid to more or less lunate, with flattened bases, (6.5-) 7-10 x 2-2.5 µm.

After 6 wk on OMA white, dark-stipitate stromata 1-2 mm high x less than 1 mm diam devoid of conidia formed. These are suspected to represent the juvenile teleomorphic stroma.

This fungus looks much like a *Podosordaria*. Among described *Podosordaria* species only *P. hircina* (Tai & Wei) Krug & Cain has ascospores in the size range of our fungus (Krug & Cain, 1974; Krug & Jeng, 1995). *Podosordaria hircina* is known from goat dung in China. It seems to differ morphologically from *P. entosulphurea* in lacking the striking yellow interior. Unfortunately, *P. hircina* has not been cultured, as is the case for most *Podosordaria* species. It is especially unfortunate that the type species, *P. mexicana* Ellis & Holw., has not been cultured. Species of *Podosordaria* that have been cultured have an anamorph assignable to *Lindquistia* Subram. & Chandrashekara, a hyphomycetous genus with disarticulating conidiogenous elements (Rogers, 1985; Rogers and Laessøe, 1992). *Poronia* Willd.: Fr. species have anamorphs also assignable to *Lindquistia* and, indeed, a case could be made for expanding the delimitation of this genus to include *Podosordaria*. Such a decision awaits the culturing of additional *Podosordaria* taxa. It is our strong opinion that anamorphic data will be indispensable in the ultimate assignment of taxa to *Podosordaria* and *Poronia* or to *Xylaria* (see also Rogers and Laessøe, 1992).

The anamorphic synnemata produced in culture, following the terminology of Seifert and Okada (1990), can be considered as indeterminate because the structure continues to grow after sporulation begins; the hyphal system is monomitic; the sporulating zone is divergent (loose) to apparently random. The putative teleomorphic synnemata from culture seem somewhat more differentiated in possessing distinctive stipes.

Entonaema globosum Heim, Bull. Mycol. Soc. France 76: 121. 1960. (published as *E. globosa*. Orthographic correction published in *Index of Fungi* 3 (3): 42. 1961.)

In a treatment of *Entonaema* A. Möller, *E. globosum* was considered a taxon of uncertain position because the type material is immature (Rogers, 1981). Moreover, type material of *forma aurantia* Heim, said to differ from the typical form in having citron-orange to deep-orange stromata (Heim, 1960), also is immature (Rogers, 1981). Rogers (1981) speculated that *E. globosum* is probably synonymous with *E. cinnabarina* (Cooke & Massee) C. G. Lloyd. However, we now believe *E. globosum* to be a distinct species with somewhat smaller ascospores and a brighter color than *E. cinnabarina*. *Entonaema cinnabarina* has orange granules beneath the surface, whereas *E. globosum* has blood-red granules. Interestingly, both *Entonaema globosum* and *forma aurantia* were described from near Rio Santiago, Oaxaca, Mexico during the same time period. We suspect that Heim was dealing with a single species ranging in color from yellow tinged with red (the typical form) to quite orange (*forma aurantia*). One of us (FSM) collected an *Entonaema* from Campeche state, Mexico that has the characteristics of *E. globosum* in the broad sense of embracing both the typical *forma* and *forma aurantia*. We here redescribe *E. globosum* assuming a single typical *forma* and neotypify it. We feel particularly justified in that the proposed neotype is from Mexico.

Stromata globose to irregular, sessile, 1.2-4 cm long x 0.9-2.7 cm broad x 0.7-1.5 cm high, externally vivid yellow to light orange with a blood-red layer immediately beneath the surface, internally at first filled with a gelatinous grayish liquid then becoming hollow with grayish white, horny internal walls. Texture hard. Surface smooth or very wrinkled, pruinose, with discrete cracking. Perithecia 0.1-0.3 mm diam. Ostioles umbilicate. Asci cylindrical, 8-spored, very long-stipitate, 136-191 μm total length x 9-8 μm broad, the spore-bearing part 48-59 μm , with apical ring bluing in Melzer's iodine reagent, rectangular to discoid, flared upward, 1 μm high x 2.5 μm broad. Ascospores light-brown to brown, ellipsoid with rounded ends, uniguttulate to biguttulate, 8-10 x 5-5.5 (-6) μm , with straight germ slit spore-length or nearly so.

SPECIMEN EXAMINED: MEXICO: Campeche state, Escárcega municipality, Ing. Eduardo Sangri Serrano Forestry Experimental Station, on wood of *Nectandra salicifolia* (H. B. K.) Nees. ("Laurelillo") in median subevergreen tropical rain forest, 9.XI.1988, San Martín, F. 1171 (WSP 69647, NEOTYPE).

ACKNOWLEDGEMENTS

PPNS No. 0222, Department of Plant Pathology, Project 1767, Washington State University, College of Agriculture and Home Economics. This study was supported by National Science Foundation Grant BSR-

9017920 to JDR. We thank Donald P. Rogers, Auburn, WA, for correcting the Latin description. We thank Michael J. Adams and Lori M. Carris, Washington State University, for photography and for reviewing the manuscript, respectively.

LITERATURE CITED

- Heim, R. 1960. Quelques ascomycètes remarquables, III. Le genre *Entonaema* Möll. du Mexique. Bull. Mycol. Soc. France 76: 121-129.
- Krug, J. C., and R. F. Cain. 1974. A preliminary treatment of the genus *Podosordaria*. Canad. J. Bot. 52: 589-605.
- Krug, J. C., and R. S. Jeng. 1995. A new coprophilous species of *Podosordaria* from Venezuela. Canad. J. Bot. 73: 65-69.
- Rogers, J. D. 1981. *Sarcoxylo* and *Entonaema* (Xylariaceae). Mycologia 73: 28-61.
- Rogers, J. D. 1985. Anamorphs of *Xylaria*: taxonomic considerations. Sydowia 38: 255-262.
- Rogers, J. D., Y.-M. Ju, and D. E. Hemmes. 1992. *Hypoxylo* *rectangulosporum* sp. nov., *Xylaria psidii* sp. nov., and comments on taxa of *Podosordaria* and *Stromatoneurospora*. Mycologia 84: 166-172.
- Rogers, J. D., and T. Laessøe. 1992. *Podosordaria ingii* sp. nov. and its *Lindquistia* anamorph. Mycotaxon 64: 435-443.
- Seifert, K. A., and G. Okada. 1990. Taxonomic implications of conidiomatal anatomy in synnematous hyphomycetes. IN: W. Gams et al., eds. Developments in the taxonomy of anamorphic fungi. Studies in Mycology No. 32, Centraalbureau voor Schimmelcultures, Baarn. p. 29-40.

MYCOTAXON

Volume LVIII pp. 489-498

April-June 1996

SOME ASTERINELLA, ASTEROSTOMELLA AND ECHIDNODELLA SPECIES FROM SOUTHERN INDIA

V.B. Hosagoudar and M.P. Balakrishnan
Botanical Survey of India, Southern Circle,
Coimbatore 641 003, India

R.D. Goos
Department of Botany, University of Rhode Island
Kingston, RI 02881, U.S.A.

SUMMARY

This paper gives an account of nine species of the genera Asterinella, Asterostomella and Echidnodella collected from southern India. Of these, Asterinella argyreiae, Asterostomella boehmeriae, A. helicteridis, A. lepianthedis, A. ligustri, A. meliosmaticola, A. radermacheriae, A. terminaliae and Echidnodella hopeae are described here as new species.

Key words: Fungi, new species, Asterinella, Asterostomella, Echidnodella, Southern India, Ascomycotina, anamorphs.

1. Asterinella argyreiae sp. nov. (Fig. 1)

Maculae infectionis epiphyllae, nigrae, gregariae, cinctae e flavus halos, ad 8 mm diam., consequentia cavernae in foliae. Hyphae leniter brunneae, rectae, irregulariter ramosae, laxae reticulatae, cellulae 5-10 x 5-6.5 μ m. Hyphopodia nulla. Thyrothecia circulatim posita in coloniae, circulatia, saepae connata, nigra, ad 130 μ m diam., stellato dehiscentes ad centre, margine crenata leniter fringiora, hyphae fringiorae luteae; asci globosi vel leniter ovati, octospori, 21-28 x 15-4 μ m; ascosporae conglobatae, cinnamomeo brunneae, 1-septatae, constrictae, cellulae uterque equaliae, 21-23 x 5-7 μ m, parietis glabrus.



Abbreviations used in all figures: a = mycelium, b = thyrothecium, c = ascus, d = ascospores, e = pycnidium, f = pycnidiospores.

Fig. 1. Asterinella argyreiae. Fig. 2. Asterostomella boehmeriae.
Fig. 3. Asterostomella helicteridis. Fig. 4. Asterostomella lepi-
anthedis. Fig. 5. Asterostomella ligustri.

Infected spots epiphyllous, black, gregarious, surrounded by yellow haloes, up to 8 mm in diameter, resulting in shot holes. Hyphae light brown, straight, branching irregular, loosely reticulate, cells 5-10 x 5-6.5 μ m. Hyphopodia absent. Thyrothecia arranged circularly in the colonies, circular, frequently connate, carbonaceous black, up to 130 μ m in diameter, dehiscing stellately at the centre, margin crenate to slightly fringed, fringed hyphae yellow; asci globose to slightly ovate, eight spored, 21-28 x 15-24 μ m; ascospores conglobate, cinnamon brown, 1-septate, constricted at septum, both cells equal, 21-23 x 5-7 μ m, wall smooth.

Holotype: On leaves of *Argyreia* sp. (Convolvulaceae), near Manjapparai, Anamalai, Coimbatore, Tamil Nadu, March 26, 1990, V.B. Hosagoudar, HCIO 30976.

This species is distinct from other *Asterinella* species in that it causes a pathogenic effect on the host (Stevens & Ryan, 1939). Entire colonies with very little mycelia were covered with thyrothecia. Hyphal branches arising from the mycelia at the tip or in the centre, give the hyphae a bead-like appearance, and are the initials of thyrothecia. Several thyrothecia may coalesce (join together) and stellate splitting takes place.

2. *Asterostomella boehmeriae* sp. nov. (Fig. 2)

Coloniae hypophyllae, nigrae, velutinae, posteriorae vertirae canae, saepe confluentes et pulverulentae, respondeore pars folia lateritiae et folia replicata in infectionae gravis. Hyphae sub-brunneae, fortiter appressae in foliae, rectae vel flexuosae, oppositae vel irregulariter acuteque ramosae, laxae reticulatae, cellulae 12-18.5 x 5-6.5 μ m. Hyphopodia uni vel bi-cellula, sessilia vel stipitata, alternata, 6-18.5 μ m longa; cellula basali (quacumque preaesens) cylindracea vel cuneata, 6-6.5 μ m longa; cellula apicali ovata, globosa, integra vel angularia (in hyphopodia sessilia), 9-12.5 x 6-8 μ m. Pycnidia dispersa, raro aggregata, orbicularia, 90-155 μ m diam., margine crenata, stellata dishiscentes ad centre; pycidiosporae numerosae, brunneae, ellipsoideae, unicellulae, attenuatae et rotundatae ad apicem, rectae vel leniter curvulae, fiscia hyalina ad centre, 18-31 x 12-15.5 μ m, parietis glabrus.

Colonies hypophyllous, black, velvety, later ash-coloured, mostly confluent, giving a dusty appearance, corresponding upper surface of the infected leaf portion turn brick red, severely infected leaves roll dorsally so as to cover the infected parts by exposing the ventral surface. Hyphae pale yellow, strongly appressed to the host epidermis, straight to flexuous, branching opposite to irregular at acute angles, loosely reticulate, cells 12-18.5 x 5-6.5 μ m. Hyphopodia one to two celled, sessile to

stalked, alternate, 6-18.5 μm long; stalk cells (when two celled) cylindrical to cuneate, 6-6.5 μm long; head cells ovate, globose, entire to angular (in sessile), 9-12.5 x 6-8 μm . Pycnidia scattered to mostly grouped, orbicular, 90-155 μm in diameter, margin crenate, dehiscing stellately at the centre, pycnidiospores brown, numerous, ellipsoidal, unicellular, tapered to broadly rounded at the apex, straight to slightly curved, a hyaline band often present in the middle, 18-31 x 12-15.5 μm , wall smooth.

Holotype: On leaves of Boehmeria glomerulifera Miq. (Urticaceae), near Sholayar Dam, Valparai, Coimbatore, March 23, 1990, V.B. Hosagoudar, HClO 30978.

This species has a pathological effect on the host.

3. Asterostomella helicteridis sp. nov. (Fig. 3)

Coloniae epiphyllae, densae, crustosae, saepe confluentes. Hyphae pallide brunneae, flexuosae vel leniter anfractuae, alternate vel irregulariter acuteque ramosae, laxae reticulatae, cellulae 15-18.5 x 3-4.5 μm . Hyphopodia pallida brunnea, unicellularia, alternata, lobata, 6-6.5 x 6-9.5 μm . Pycnidia dispersa, orbicularia, raro connata, 75-80 μm diam., stellato dehiscentes ad centre, margine crenata; pycnidiosporae numerosae, late ovatae vel globosae, intense brunneae, fisciae hyalinae nullae, 15-18.5 x 12-15.5 μm , parietis glabrus.

Colonies epiphyllous, dense, crustose, widely confluent. Hyphae pale brown, flexuous to slightly crooked, branching alternate to irregular at acute angles, loosely reticulate, cells 15-18.5 x 3-4.5 μm . Hyphopodia pale brown, unicellular, alternate, lobate, 6-6.5 x 6-9.5 μm . Pycnidia scattered, orbicular, rarely connate, 75-80 μm in diameter, stellately dehiscing at the centre and later opening widely, margin crenate; pycnidiospores many, broadly ovate to globose, deep brown, central hyaline band absent, 15-18.5 x 12-15.5 μm , wall smooth.

Holotype: On leaves of Helicteres isora L. (Sterculiaceae), Srimadurai, Gudalar, Tamil Nadu, Jan. 25, 1990, V.B. Hosagoudar, HClO 30979.

Asterina leptalea Sydow has been reported on this host (Sydow, 1913) but differs from it in the morphology and measurements.

4. Asterostomella lepianthedis sp. nov. (Fig. 4)

Coloniae amphigenae, plerumque epiphyllae, tenues vel densae, ad 1 mm diam., confluentes. Hyphae rectae, flexuosae vel anfractuae, irregulariter acuteque ramosae, laxae reticulatae, cellulae 12-33 x 3-4.5 μm . Hyphopodia

dispersa, alternata vel unilateralia, recta vel curvula, bicellula, 9-12.5 μ m longa; cellula basali cuneata vel cylindracea, 3-6.5 μ m longa; cellula apicali ovoidea, integra vel lobata, 4.5-9.5 x 4.5-6 μ m. Pycnidia plerumque dispersa, orbicularia, ad 72 μ m diam., stellato dehiscentes ad centre, margine crenata; pycnidiosporae unicellulariae, globosae vel ellipsoideae, brunneae, 9-15 x 6-9.5 μ m parietis glabrus.

Colonies amphigenous, mostly epiphyllous, thin to dense, up to 1 mm in diameter, confluent. Hyphae straight, flexuous to crooked, branching irregular at acute angles, loosely reticulate, cells 12-33 x 3-4.5 μ m. Hyphopodia scattered, alternate to unilateral, straight to curved, two-celled, 9-12.5 μ m long; basal cells cuneate to cylindrical, 3-6.5 μ m long; head cells ovoid, entire to lobed, 4.5-9.5 x 4.5-6 μ m. Pycnidia scattered, orbicular, up to 72.5 μ m in diameter, stellately dehiscent at the centre, margin crenate; pycnidiospores unicellular, globose to ellipsoidal, brown, 9-15 x 6-9.5 μ m.

Holotype: On leaves of Lepianthes umbellata (L.) Rafin. [Hackeria subpeltata (Willd.) Kunth] (Piperaceae), Benne Forest, Gudalur, Nilgiris, Tamil Nadu, Jan. 24, 1990, V.B. Hosagoudar, HClO 30980.

Repeated collections from Nilgiris and Anamalai (Coimbatore dist.) of Tamil Nadu did not show any ascigerous states. This species is distinct from other anamorphs of Asterina species reported on the members of the family Piperaceae in its morphology and measurements (Stevens & Ryan, 1939; Doidge, 1942).

5. Asterostomella ligustri sp. nov. (Fig. 5)

Plagulae infectionis hypophyllae, tenues, immundogriseae, ad 10 mm diam. Hyphae anfractuae, irregulariter acutaeque ramosae, laxae reticulatae, cellulae 9-18.5 x 9-9.5 μ m. Hyphopodia alternata, recta vel curvula, sessilia vel stipitata, irregulariter lobata ad apicem, 6-6.5 x 9-9.5 μ m. Pycnidia dispersa, 90-100 x 68-90 μ m, rotunda, stellato dehiscentes ad centre, margine crenata; pycnidiosporae intense brunneae, ovalae, attenuate ad ambum terminalis, terminorae late rotundae, 15-18.5 x 9-9.5 μ m.

Infection spots hypophyllous, thin, dirty grey, up to 10 mm in diameter. Hyphae crooked, branching irregular at acute angles, loosely reticulate, cells 9-18.5 x 9-9.5 μ m. Hyphopodia alternate, straight to curved, sessile to stipitate, irregularly lobed at the apex, 6-6.5 x 9-9.5 μ m. Pycnidia scattered, round, 90-100 x 68-90 μ m, stellately dehiscent at the centre, margin crenate; pycnidiospores deep brown, oval, tapering towards both ends, ends broadly rounded, 15-18.5 x 9-9.5 μ m.

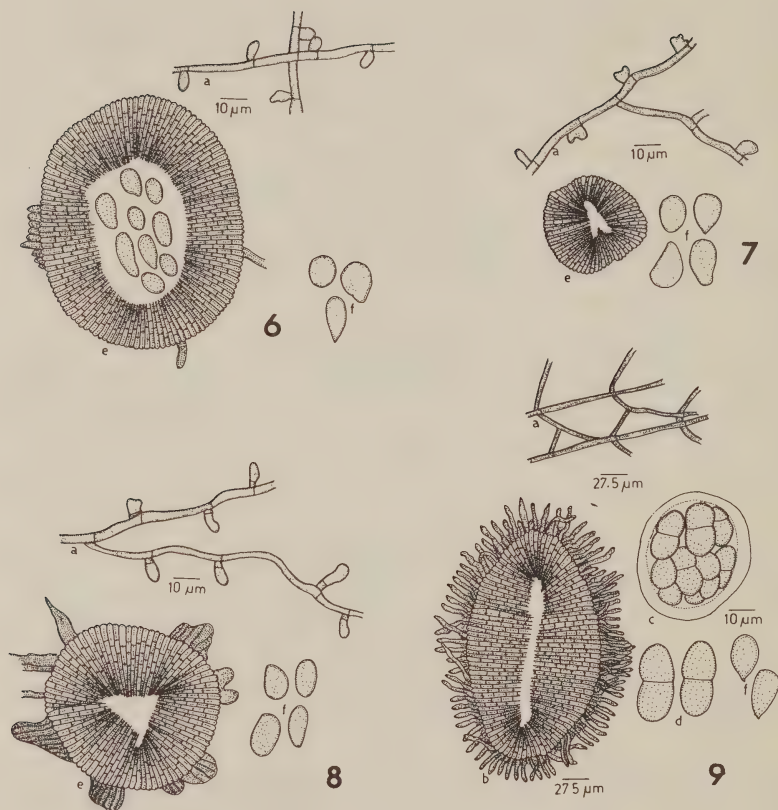


Fig. 6. *Asterostomella meliosmaticola*. Fig. 7. *Asterostomella radermacherae*. Fig. 8. *Asterostomella terminaliae*. Fig. 9. *Echidnodella hopeae*.

Holotype: On leaves of Ligustrum gamblei Ramam. (Oleaceae), near Nirar Dam, Anamalai, Coimbatore, Tamil Nadu, Dec. 27, 1990, V.B. Hosagoudar, HCIO 30981.

This species resembles the pycnidial form of Asterina erysiphoides Kalch. & Cooke (Doidge, 1942; Hansford & Thirumalachar, 1948) but differs from it in the absence of a central median hyaline band in the pycnidiospores.

6. *Asterostomella meliosmaticola* sp. nov. (Fig. 6)

Coloniae amphigenae, plerumque epiphyllae, tenues vel densae, crustosae, ad 2 mm diam., confluentes. Hyphae flexuosae vel linititer anfractuae, alternate vel irregulariter acuteque ramosae, laxae reticulatae, cellulae 15-34 x 3-4.5 um. Hyphopodia alternata, dispersa, unicellularia, recta vel curvula, ovala vel globosa, integra vel raro lobata, 6-12.5 x 4-6.5 um. Pycnidia dispersa, rotunda vel leniter irregulariter, raro connata, ad 140 um diam., stellato dehiscentes ad centre, margine fimbriata, hyphae fringiorae flexuosae; pycnidiosporae ovoideae, ellipsoideae vel plerumque pyriformiae, 15-18.5 x 12-13 um.

Colonies amphigenous, mostly epiphyllous, thin to dense, crustose, up to 2 mm in diameter, confluent. Hyphae flexuous to slightly crooked, branching alternate to irregular at acute angles, loosely reticulate, cells 15-34 x 3-4.5 um. Hyphopodia alternate, scattered, unicellular, straight to curved, oval to globose, entire to rarely lobate, 6-12.5 x 4-6.5 um. Pycnidia scattered, round to slightly irregular, rarely connate, up to 140 um in diameter, stellately dehiscent at the centre, margin fimbriate, fringed hyphae flexuous; pycnidiospores ovoid, ellipsoidal to predominantly pyriform, 15-18.5 x 12-13 um.

Holotype: On leaves of Meliosma simplicifolia (Roxb.) Walp. subsp. simplicifolia (Sabiaceae), Benne Forest, Gudalur, Nilgiris, Tamil Nadu, Jan. 24, 1990, V.B. Hosagoudar, HCIO 30982.

Repeated collections from the Western Ghats region of southern India yielded only the pycnidial state. The new species differs from the anamorph of Asterina meliosmaticola Petr. & Ciff. in the morphology and measurements of hyphopodia and pycnidiospores (Petrak & Cifferi, 1932).

7. *Asterostomella radermacheriae* sp. nov. Fig. 7)

Coloniae epiphyllae, densae, ad 2 mm diam., raro confluentes. Hyphae flexuosae, alternate vel irregulariter acuteque vel laxae ramosae, laxae reticulatae, cellulae, 24-28 x 3-5 um. Hyphopodia alternata, ad 1% opposita, recta curvula, sessilia vel stipitata, 6-15.5 um longa; cellula basali (si praescens) cylindracea vel cuneata, 2-12.5 um

longa; cellula apicali ovata, globosa, integra, angularia vel sublobata, 3-8 x 5-8.5 um. Pycnidia plerumque dispersa, rotunda, 37-46.5 um diam., portio centrali dissolve et pycnidiosporae expositae, margine crenata; pycnidiosporae intense brunneae, globosae vel piriformiae, 15-18.5 x 12-14 um.

Colonies epiphyllous, dense, up to 2 mm in diameter, rarely confluent. Hyphae flexuous, branching alternate to irregular at acute to wide angles, loosely reticulate, cells 24-28 x 3-5 um. Hyphopodia alternate, about 1% opposite, straight to curved, sessile to stipitate, 6-15.5 um long; stalk cells (where stipitate) cylindrical to cuneate, 2-12.5 um long; head cells ovate, globose, entire, angular to sublobate, 3-8 x 5.8.5 um. Pycnidia mostly scattered, round, 37-46.5 um in diameter, central portion dissolved and pycnidiospores exposed, margin crenate; pycnidiospores deep brown, globose to pyriform, 15-18.5 x 12-14 um.

Holotype: On leaves of Radermachera xylocarpa (Roxb.) K. Schum. (Bignoniaceae), in the forest between Painavu and Kulamavu, Idukki, Kerala, Dec. 25, 1984, V.B. Hosagoudar, HCTO 30983.

The new species differs from the anamorphs of Asterina memorae Henn. and A. inaequalis Mont. var. nodulosa Theiss. in having entire to lobate hyphopodia and smaller pycnidiospores (Hennings, 1904; Theissen, 1913).

8. *Asterostomella terminaliae* sp. nov. (Fig. 8)

Coloniae epiphyllae, tenues, crustosae, ad 5 mm diam., confluentes. Hyphae flexuosae vel anfractuae, oppositae, alternate vel irregulariter acuteque ramosae, laxae reticulatae, cellulae 15-37 x 3-4.5 um. Hyphopodia alternata vel unilateralia, bicellula, recta vel diverse curvula, 9-12.5 um longa; cellula basali cylindracea vel cuneata, 2-3.5 um longa; cellula apicali ovata, globosa, aculeata vel truncata ad apicem, integra vel raro lobata, 4-6.5 x 4.5-6.5 um. Pycnidia dispersa, late rotunda, ad 62 um diam., stellato dehiscentes ad centro, margine crenata; pycnidiosporae ovoidae vel ellipsoideae, brunneae, unicellulariae, dilutus medius fascia visa, 15-17 x 5-7 um.

Colonies epiphyllous, thin, crustose, up to 5 mm in diameter, confluent. Hyphae flexuous to crooked, branching opposite, alternate to irregular at acute angles, loosely reticulate, cells 15-37 x 3-4.5 um. Hyphopodia alternate and unilateral, 2-celled, straight to curved, 9-12.5 um long; stalk cells cylindrical to cuneate, 2-3.5 um long; head cells ovate, globose, pointed to truncate at apex, entire to rarely lobate, 4-6.5 x 4.5-6.5 um. Pycnidia scattered, roughly rounded, up to 62 um in diameter, stellately dehiscent at the centre, margin crenate;

pycnidiospores oval to ellipsoidal, brown, unicellular, central lighter median band present, 15-17 x 5-7 μ m.

Holotype: On leaves of Terminalia paniculata Roth (Combretaceae), Benne Forest, Gudalur, Nilgiris, Tamil Nadu, Jan. 24, 1990, V.B. Hosagoudar HClO 30984.

Based on the lighter median band in the pycnidiospores, the new species is similar to the anamorph of Asterina combreti Sydow reported on Combretum species (Doidge, 1942) but differs from it in having smaller capitate hyphopodia and pycnidiospores. It also differs from Asterina terminaliae Thite in morphology and size.

9. Echidnodella hopeae sp. nov. (Fig. 9)

Coloniae foliicolae, amphigenae, orbiculare, ad 3 mm diam., raro confluentes. Hyphae rectae, plerumque oppositae acuteque ramosae, laxae reticulatae, cellulae 18-28 x 6-8 μ m. Hyphopodia nulla. Thyrothecia rotunda, ovata et elongata, dispersa, raro connata, 200-375 μ m diam., stellecto vel longitudinalialae dehiscentes ad centro, margine crenata vel fimbriata, hyphae fringiorae rectae, compactae et parallelae, longiorae; asci numerosi, globosi, octospori, 45-50 μ m diam., ascospores cinnamomeae brunneae, obovatae, conglobatae, 1-septatae, constrictae, 30-32 x 12-15.5 μ m. Pycnidia numerose, similis thyrothecia; pycnidiosporae altus brunneae, piriformiae, leniter papillatae, 12-13 x 9-10 μ m. Colonies foliicolous, amphigenous, orbicular, up to 3 mm in diameter, rarely confluent. Hyphae straight, branching mostly opposite at acute angles, loosely reticulate, cells 18-28 x 6-8 μ m. Hyphopodia absent. Thyrothecia round, oval to elongated, scattered, rarely connate, 200-375 μ m in diameter, stellately to longitudinally dehiscent at the centre, margin crenate to fimbriate, fringed hyphae straight, closely aggregated and parallel; asci many, globose, eight spored, 46-50 μ m in diameter; ascospores obovate, conglobate, 1-septate, deeply constricted at the septum, cinnamon brown, 30-32 x 12-15.5 μ m. Pycnidia many, same as thyrothecia; pycnidiospores deep brown, pyriform, slightly papillate, 12-13 x 9-10 μ m.

Holotype: On leaves of Hopea ponga (Dennst.) Mabblerley (Dipterocarpaceae), Konaje, Mangalore, Karnataka, May 23, 1992, B. Rajeshwari Dayal HClO 30977 (As Asterinella hopea).

This species differs from Echidnodella dipterocarpi (Henn.) Theiss. & Sydow reported on Dipterocarpus sp. (Theiss. & Sydow, 1917) in having smaller perithecia, asci and ascospores.

ACKNOWLEDGEMENTS

One of us (VBH) is grateful to the "Scientist's Pool Scheme" of CSIR, New Delhi for the financial assistance. We thank Dr. Richard T. Hanlin for reviewing the manuscript.

REFERENCES

- Doidge, E.M. 1942. Revision of the South African Microthyriaceae. Bothalia 4: 273-344.
- Hansford, C.G. and M.J. Thirumalachar 1948. Fungi of South India. Farlowia 3: 285-3144.
- Hennings, P. 1904. Fungi Amazonici. Hedwigia 43: 350-400.
- Stevens, F.L. and M.H. Ryan 1930. The Microthyriaceae. Illinois Biol. Monographs 2: 1-138.
- Sydow, H. and P. Sydow 1913. Enumeration of Philippine fungi with notes and description of new species. Philippine J. Sci. 2: 265-185; 475-505.
- Theissen, F. 1913. Hemispheriales. Ann. Mycol. 11: 468-469.
- Theissen, F. and H. Sydow 1913. Synoptische Tafun. Ann. Mycol. 15: 389-491.

BOOK REVIEWS

D. S. Hibbett, Book Review Editor

Observationes Mycologici (vols. 1 and 2, 608 pp, +16 plates), **Systema Mycologicum** (vols. 1 and 2, 1142 pp), **Systema Mycologicum** (vol. 3) and **Elenchus Fungorum** (676 pp, plus Index, 202 pp), by Elias Magnus Fries. 125 x 205 mm, 1815-1828, reprinted 1995. Associazione Micologica Bresadola, 46 Via Alessandro Volta, Trento 38100, Italy. Fax: 461-913960. Italian lire £120,000.

A review of a reprint edition could be concise and relatively uninformative: numbers of pages, quality of reproduction, strength of binding and the like. In this three-volume set, quality of reproduction is excellent, especially considering that text material was sometimes not totally clear in its original form. Paper quality good; slightly cream-colored so as to be kind to the eyes. Binding more than adequate, and attractive. All in all, a fine job delivered with respect as a commemoration of the 200th anniversary of Fries's birth (August 15, 1794).

But all this said, the more interesting story by far is the context in which these prodigious works were originally produced. They were not, after all, Fries's only publications—neither his first nor his last. They were written within the context of his life-course and of history in general.

Smaland was at the other end of Sweden from Stockholm, and Femsjo, Fries's birthplace, was a bucolic hamlet. That France was in the throes of revolution, with heads rolling, could have only elicited head-shaking, if communication of the day brought such information to such a place at all. Elias's father was the town vicar whose influence must have been heavy on the young boy. After all, Latin, not Swedish, was the *lingua franca* between father and son, and the father's love of and interest in natural history rubbed off early on Elias. By the time the boy entered secondary school in 1803 (age nine), he was taking daily botanical excursions, and by 1811 he knew the names of all flowering plants and 3-400 fungi. What can be said of a boy whose hobby and passion was collecting and mounting plant specimens, and using Linnaeus's **Species Plantarum** and **Systema Naturae** to identify them?

But Fries was also precocious in his willingness to share his knowledge. After three years of work, he published a flora of Vaxjo County in 1809 (age 15), and a year later a companion piece on Femsjo (age 16). These were followed by a series of locally distributed broadsides on local natural history. During a trip to Copenhagen in 1812 (age almost 18) he complained that there was no time to collect plants, for attractive but worthless sight-seeing consumed his days. Only 500-600 specimens had been gathered!

Fungi and lichens assumed a growing importance in Elias's life, largely, we are told, because he already knew the green plants so well. His first major publication on fungi, **Observationes Mycologici**, in two volumes (1815, the same year in which Napoleon's army was defeated at Waterloo, and 1818) were in the continuum of his prolific publication schedule. A measure of his mastery of the subject: in the **Observationes** he used 896 names to represent taxa lower than genus, of which he coined or revised over 40%.

Permeating all intellectual thought of the day was *Naturphilosophie*, the German Romantic construct championed by Wolfgang Goethe, among others. This construct was idealistic—the basic scheme was inductive, not deductive, and so science was bound to suffer. Fries was part of the movement, and especially his **Systema** and **Elenchus** reflect this imposed schema.

Fries excelled in his studies at the University at Lund. He was awarded a master's degree in 1811, and in November, 1814, he obtained his doctorate and was appointed as docent in the same university. In this span of years the War of 1812 was fought between England and the fledgling United States. It was during these years that Fries annually visited Copenhagen and there became friends with J. W. Hornemann, editor of the famous **Flora Danica**, who later helped Fries to publish the **Observationes**. Fries was becoming well-connected as well as prodigious. Publications on local botanical finds and practical scientific subjects followed from Lund.

Using only the limited literature available in the Copenhagen and Lund libraries (notably Persoon's **Synopsis**, and Albertini and Schweinitz's **Conspectus**), Fries soon realized that the reason why fungi could not be identified (as vascular plants could) was that they were not accurately described, either in characters or numbers. This shortfall must be corrected, and the result of careful personal collecting and documentation was his **Systema Mycologicum** (volume 1, officially 1821, but quite likely 1820, age 26, while Beethoven was composing his ninth symphony; volume 2 a year later) which was compiled and written in Lund. His reputation grew, as did his rank, additional publications appeared, he married,

and a family was begun, even as he lectured and traveled to Copenhagen. Recognizing that many higher fungi had been overlooked in **Systema** volume one, he compiled his latest notes into **Elenchus Fungorum** (1828; age 34). He could no longer be considered a child prodigy—he was a maturing scientist. Volume three of **Systema** appeared in 1832 (age 38). In 1834, he was offered, and accepted, the chair in botany at the University of Uppsala, to which he is most often linked.

Interestingly, in **Systema** and **Elenchus**, Fries accepted (today we would use the term "sanctioned") only about 55% of the names he used in the **Observationes**, but did not accept the other 45%.

As time passed in Uppsala, where the forest flora differed markedly from that of Smaland, as did the fungi, small publications were issued and perhaps more significantly, students wished to defend theses and dissertations. As was usual at that time, the professor wrote the thesis and the student defended it. Thus at least a dozen such documents were compiled, each adding to Fries's insight into particular fungal groups and forcing him to investigate separating characters and more accurately distinguish taxa. He was led to accept more numerous, smaller, more accurately delineated genera (we would call them "split genera"), so that by the 1830s, much more knowledge about the fungi had been uncovered, both from new literature and from personal observations. This was the context in which **Epicrisis Systematis Mycologici** was compiled for publication in two volumes in 1836 and 1838 (age 42, 44).

Fries's **Observationes** were the publications of an upstart, albeit remarkable for their time. **Systema** and **Elenchus** were more mature, although still under the spell of Romanticism. Finally, **Epicrisis** is the work of a mature scientist—concise, wide-ranging. It could be argued that these major compilations, of which the **Observationes**, **Systema**, and **Elenchus** have been sumptuously reprinted by the Gruppo Bresadola, were Fries's best contributions. Their centerpieces, **Systema** and **Elenchus**, of course, were singled out by mycologists early in the 20th century to serve as "starting points" for fungus nomenclature (along with Persoon's **Synopsis**), and in spite of extensive tinkering over the years, they still occupy a hallowed place in mycological literature. This reprint edition again offers all mycologists an opportunity to own these seminal works.

For much more on Fries's life, see **Hymenomycetes in the perspective of 200 years**, edited by N. Lundqvist, and R. Moberg (*Symbolae Botanicae Upsalienses* 30:3, 212 pp, 1995). Ronald H. Petersen, Botany Department, University of Tennessee, Knoxville, TN 37996-1100 U.S.A.

British Puffballs, Earthstars and Stinkhorns, An Account of the British Gasteroid Fungi, by D. N. Pegler, T. Læssøe, and B. M. Spooner. 155 x 240 mm, 255 pp, softcover, 1995. Royal Botanic Gardens Kew, Whitstable Litho, Whitstable, Kent, U.K. Tel.: 44 (0)81-332-5217/5299. Fax: 44 (0)81-332-5278. £30.00 ISBN 0947643 81.8.

This compact field guide covers 73 species of gasteromycetes in five orders, including: Sclerodermatales, Tulostomatales, Nidulariales, Lycoperdales, and Phallales. There are 86 color plates with some taxa illustrated more than once. Keys to the families, genera, and species are accompanied by descriptions of each genus and species. The descriptions include both macroscopic and essential microscopic features. The microscopic features are illustrated by drawings beneath the color illustration for each species. Illustrative material is located on the page facing the species description.

Distribution maps of Great Britain and Ireland are provided for each species in the appendix, along with a short three page glossary. The introduction includes historical information, the form and structure of the gasteroid fruiting body, and abbreviated information on distribution and habitats, including a table on habitat preferences. Also included is information on how to collect and examine gasteroid fungi and a four-page section on folklore and uses of gasteromycetes.

A five-page key to the British hypogeous gasteroid fungi which are not described in the text is presented. The more detailed treatment of these taxa was presented by Pegler, Spooner, and Young in **British Truffles, A Revision of the British Hypogeous Fungi** (1993). One should note that "truffles" is a generic term as used here, and the ascomycete members of the Tuberales which are often referred to as "truffles" are not included in this guide. In many mycological works the hypogeous basidiomycetes would be referred to as "false truffles."

There is everything to like and nothing to dislike about this field guide. The authors have extracted all the features which one would wish to have in a guide and incorporated them into this work. The editing has been done in superior fashion and the critical use of bold type and italics makes specific features easy to find. Many of the species of gasteromycetes and decomposers are found throughout the Northern Hemisphere and beyond, giving the guide a wide appeal. It is of interest especially elsewhere on the European Continent, but is also useful for those who study the higher fungi in North America and Asia. Even the Sclerodermatales, a

mycorrhizal order, has species described which have wide distributions. All of the included taxa are reported from North America for example. I can find no fault with the color illustrations. They exhibit excellent diagnostic views and are reproduced very well. This is a valuable contribution to our knowledge of the higher fungi. It will be most useful for mycologists and biologists far beyond the borders of the British Isles. *Orson K. Miller, Jr., Department of Biology, Virginia Polytechnic Institute, Blacksburg, VA, 24061, U.S.A.*

Introductory Mycology, Fourth Edition, by C. J. Alexopoulos, C. W. Mims, and M. Blackwell. 240 x 200 mm, 868 pp, clothbound, 1995. John Wiley & Sons, Inc., 605 3rd Ave., New York, NY 10158. Tel.: (212) 850-6000 Fax: (212) 850-6088. US \$84.95. ISBN 0-471-52229-5.

For well over a decade, **Introductory Mycology, Third Edition** was the standard reference for taxonomic and general mycology. Of course, in a healthy discipline, no textbook can remain current for more than a few years, and so it is very welcome that **Introductory Mycology, Fourth Edition** has just been released. This new edition continues in the taxonomic tradition of its predecessor, but it incorporates insights from the last sixteen years of research in all fields of mycology, especially systematics.

A comparison of the opening chapters of the third and fourth editions illustrates the changes in mycology that have occurred since 1979. In the third edition, the first chapter (43 pp) covered the practical importance of fungi, general characteristics of fungi, and fungal classification. The new edition devotes three separate chapters (85 pp) to these subjects. The entire first chapter is dedicated to the practical and cultural significance of fungi for humans. Giving these issues so much space was wise. Most students in mycology courses will not go on to become mycologists, but if we can convince them of the importance of fungi in their lives, then our science, and society in general, will benefit. The second chapter covers general characteristics of fungi. Here the recent advances in understanding of cell biology, hyphal growth, spore production, and other basic attributes of fungi are evident. The third chapter of the fourth edition covers higher-level fungal systematics (the third edition gave only eight pages to this topic). The dramatic progress of the last sixteen years is immediately apparent: whereas the third edition began its discussion of fungal systematics by saying, "The classification of the fungi presents innumerable difficulties with which you as a beginning student need not be

confronted," the fourth edition opens this chapter with a cladogram of the fungi (and non-fungi) based on phylogenetic analysis of 18S ribosomal DNA sequences. In addition to a phylogenetically-based overview of fungi, Chapter three of the new edition also includes a brief review of phylogenetic systematics, paleomycology, and botanical nomenclature. Chapters 1-3 of the new edition can stand on their own as an introduction to fungal biology and biodiversity. They would make an excellent reading assignment for the mycology section of a general course on the diversity of life.

Chapters 4-29 describe in detail the various groups of fungi. Our understanding of fungal phylogeny is still far from complete, and so some chapters treat groups that are acknowledged to be polyphyletic, such as the deuteromycetes (Chapter 8) or the gasteromycetes (Chapter 18). Chytrids and zygomycetes receive three chapters between them. Basidiomycetes and ascomycetes receive nine and seven chapters, respectively. Introductory chapters to the ascomycetes and basidiomycetes provide useful overviews of these groups, including cladograms that show proposed relationships of the major subdivisions. By referring back to the more general cladograms in Chapter three, it should be easy for students to comprehend the hierarchical relationships of the major groups of fungi. Organisms traditionally treated as fungi, but not in the monophyletic Kingdom *Fungi* are treated in the final seven chapters. The book is amply illustrated with light and electron micrographs, photographs, drawings, and life-cycle diagrams. The reference lists following each chapter add up to a massive literature review. There are separate subject and author indexes, as well as a glossary to mycological terms.

This textbook is ideal for mycology courses that are oriented along taxonomic lines. In the Preface, the authors suggest that the index can be used to seek out topics such as "plant pathogens" or "medically important fungi," but courses that strongly emphasize such topics may find this book too limited. Nevertheless, this is an essential reference for all serious students of mycology, including industrial and medical mycologists. There is no other single source that reviews the current knowledge in fungal systematics with such breadth and depth. Given its price and density, it may not be appropriate to ask every undergraduate mycology student to purchase this book, but at least one copy should be in every mycology classroom. Considering how long it may be before a fifth edition is published, it may be worth purchasing a set of copies to keep on reserve or to lend out for a semester at a time. *D.S.H.*

Ganoderma: Systematics, Phytopathology and Pharmacology (Proceedings of Contributed Symposia 59A and 59B 5th International Mycological Congress, Vancouver, August 14-21, 1994), edited by P. K. Buchanan, R. S. Hseu, and J. M. Moncalvo. 260 x 185 mm, 183 pp, softcover, 1995. Dr. Hseu Ruey-Shyang, Applied Microbiology Laboratory, Agricultural Chemistry Department, National Taiwan University, Taipei, Taiwan, Republic of China. Fax: 886-2-363-1814. US \$25.- ISBN 957-9019-76-2.

Ganoderma is a cosmopolitan, taxonomically complex genus of wood-decaying polypores that has come under increased scrutiny for its possible medicinal properties. Two sessions were required at the Fifth International Mycological Congress to present the contributed papers on various aspects of the biology of *Ganoderma*. This slim volume brings together fifteen papers on systematics, phytopathology, wood decay, and pharmacology of *Ganoderma*. The authors represent eleven countries. Two additional communications promote an Electronic Database for Ganodermataceae and The *Ganoderma* International Research Institute, each of which promise to increase communication among *Ganoderma* researchers worldwide. The book is well-produced and includes a useful index. All those who wish to keep up with the active field of *Ganoderma* research should consult this volume. *D.S.H.*

NOTICE

Publication of S. C. Teng's FUNGI OF CHINA

MYCOTAXON, LTD. announces the publication in March 1996 of the first edition of what is possibly the most important book ever published on the fungal flora of China, S. C. Teng's *magnum opus*, the summary and culmination of the work of China's most important systematic mycologist. It is the first major treatment of the fungi of China available in English. It provides a fairly modern, often very advanced, taxonomic arrangement, insightful and detailed descriptions, references to previous treatments of each fungus both in China and elsewhere in the world, references to the basionyms of the epithets employed, known Chinese hosts and substrata, and localities by province where each fungus was collected. It is edited by Richard P. Korf.

Teng's daughter, Rosaline Z. Deng, has provided the Foreword for this volume, an insightful history of Teng and of the tangled history of this book, which she refers to as "this blood-and-sweat-soaked work." The tragedy of Teng's persecution during the Cultural Revolution in China, and his eventual exoneration and rehabilitation in 1978, eight years after his death, is chilling reading, describing the misery and physical torture to which he and his family were subjected.

The book is cloth-bound, containing 586 + xiv pages, one map, one photograph, 426 illustrations, and an index to all fungus taxa. A translation of an earlier draft into Chinese was published in 1963, but that lacked all the important literature citations so scrupulously recorded by Teng. Thousands of corrections and additions were made to the manuscript after the Chinese version was published, new keys were often provided, and new taxonomic arrangements were implemented. The book is priced at \$79.00 *postpaid surface mail*, or \$94.00 *postpaid air mail* through Mycotaxon, Ltd., P.O. Box 264, Ithaca, NY 14851, U.S.A. or your local book dealer (ISBN 0-930845-05-6) at a perhaps slightly higher price. The book may also be ordered through Mycotaxon, Ltd.'s e-mail address, <rkorf@innet.com>. To order by VISA or MasterCard provide all numbers and expiration date, as well as the cardholder's name embossed on the card.

NOTICE

Repurchase of Back Volumes of MYCOTAXON

MYCOTAXON, LTD. will repurchase copies in good condition of three back volumes of MYCOTAXON from subscribers or purchasers who no longer desire to keep them. These are volumes in short supply, and we will pay \$60 per volume if the returned volumes are in saleable condition.

The desired volumes are:

Volume 1 (3 numbers), Sept. 1974–Mar. 1975

Volume 34 (2 numbers), Jan.–Mar. 1989

Volume 46 (1 number), Jan.–Mar. 1993

If you have any of these volumes and no longer need them, contact MYCOTAXON, LTD. at P.O. Box 264, Ithaca, NY 14851 or send us an e-mail message to <rkorf@innet.com> advising us which volume or volumes you wish to sell. We will respond with mailing instructions and on receipt of the returned volume(s) will mail you our check in full payment (at \$60 each), providing the volumes are in saleable condition. This offer is only good until such time as we have replenished our stock of these back volumes. All three volumes are, of course, still available on *microfiche* and *microfilm*.

Errata, Volume 57

page 507	column 2, line 29	[Ganoderma] <i>add</i> 496
	column 2, <i>after</i> line 30	<i>insert</i> hildebrandii, 496
	column 2, <i>after</i> line 33	<i>insert</i> leucocreas, 496
	column 2, <i>after</i> line 34	<i>insert</i> nigrolucidum, 496

Author Index, Volume Fifty-Eight

- Adler, Mónica T.** A Comparative Study on *Punctelia colombiana* and *Punctelia sticta* (Parmeliaceae, Lichenized Ascomycotina). 77-92
- Alcorn, J. L., and J. Walker** *Sphaerophragmium quadricellulare* sp. nov. (Mycota, Uredinales) on *Acacia* in Australia, with Brief Notes on Some Related Rust Genera. 325-330
- Ammirati, J. F.** see Moser and Ammirati
- Balakrishnan, M. P.** see Hosagoudar, Balakrishnan and Goos
- Barr, Margaret E., and Annette W. Ramaley** Two More Species of *Amphisphaeria* (Xylariales). 349-351
- Bhat, R. B.** see Thomas and Bhat
- Blackwell, Will H., and Martha J. Powell** An Analysis of Works Of and Upon, Curtis Gates Lloyd. 353-374
- Braun, Uwe** see Shin and Braun
- Calvelo, Susana** Noteworthy Reports on *Anzia* (Lichenized Ascomycotina) from Southern South-America. 147-156
- Cano, J.** see Castañeda Ruiz, Cano and Guarro
 _____ see Castañeda Ruiz, Guarro and Cano
- Castañeda Ruiz, R. F., J. Cano and J. Guarro** Notes on Conidial Fungi. VII. Two New Species of *Beltraniella* from Cuba. 243-251
 _____, J. Guarro and J. Cano Notes on Conidial Fungi. VIII. Two New Species of *Dactylaria* from Cuba. 253-258
- Chaudhary, Ritesh K.** see Singh, Chaudhary and Morgan-Jones
- Constantinescu O.** *Peronospora* on *Acaena* (Rosaceae). 313-318
- Crous, P. W., and A. Peerally** *Gliocladiopsis irregularis* sp. nov. and Notes on *Cylindrocladium spathiphylli*. 119-128
- De, A. B.** see Roy and De
- Elix, John A.** see Mayrhofer, Matzer, Wippel and Elix
- Feige, G. B.** see Lumbsch and Feige
- Goos, R. D.** see Hosagoudar, Balakrishnan and Goos
- Guarro, J.** see Castañeda Ruiz, Cano and Guarro
 _____ see Castañeda Ruiz, Guarro and Cano
- Guderley, Roland, and H. Thorsten Lumbsch** The Lichen Genus *Diploschistes* in South Africa (Thelotremaaceae). 269-292
- Hattori, Tsutomu, and Leif Ryvarden** Polypores from Bonin Is. (Japan) II. Two New Species of *Phellinus* (Hymenochaetaceae, Basidiomycotina). 129-135
- Hertel, H.** see Rambold, Sipman and Hertel
- Hibbett, D. S.** Book Reviews. 499-505
- Ho, H. H.** The Genus *Phytophthora* in Mainland China. 93-118
- Hosagoudar, V. B., M. P. Balakrishnan and R. D. Goos** Some *Asterinella*, *Asterostomella* and *Echidnodella* Species from Southern India. 489-498
- Huhndorf, Sabine M.** see Ju, Rogers and Huhndorf
- Ju, Yu-Ming, Jack D. Rogers and Sabine M. Huhndorf** *Valsaria* and Notes on *Endoxylina*, *Pseudothyridaria*, *Pseudovalsaria* and *Roussoella*. 419-481
 _____ see Rogers, San Martin and Ju
- Lumbsch, H. Thorsten, and G. B. Feige** Comments on the Exsiccat "Lecanoroid Lichens" III. 259-267
 _____ see Guderley and Lumbsch
- Lunghini, Dario, and Flavia Pinzari** Studies on Mediterranean Hyphomycetes. I. *Pseudospiropes dumeti* sp. nov. 343-348
- Matzer, Mario** see Mayrhofer, Matzer, Wippel and Elix
- Mayrhofer, Helmut, Mario Matzer, Anita Wippel and John A. Elix** The Genus *Dimelaena* (Lichenized Ascomycetes, Physciaceae) in the Southern Hemisphere. 293-311

- Moravec, Jiří** *Scutellinia totaranuiensis* spec. nov., a New Species from New Zealand (Discomycetes, Pezizales). 233-241
- Morgan-Jones, Gareth** see Singh, Chaudhary and Morgan-Jones
- Moser, M. M., and J. F. Ammirati** Studies on North American Cortinarii II. Interesting and New Species Collected in the North Cascade Mountains, Washington. 387-412
- Peerally, A.** see Crous and Peerally
- Pinzari, Flavia** see Lunghini and Pinzari
- Powell, Martha J.** see Blackwell and Powell
- Priest, Michael J.** *Albugo* spp. on the Gentianaceae. 69-76
- Quadraccia, Livio** Studies on Italian Gasteromycetes. I. Two New Species of *Arachnion* and *Radiigera* (Basidiomycotina, Lycoperdales) from Rome and its Environs. 331-341
- Ramaley, Annette W.** see Barr and Ramaley
- Rambold, G., H. Sipman and H. Hertel** A New Species of *Miriquidica* from the Coastal Desert in Baja California. 319-324
- Rogers, Jack D., Felipe San Martin and Yu-Ming Ju** Mexican Fungi: *Xylaria entosulphurea* sp. nov. and Neotypification of *Entonaema globosum*. 483-487
see Ju, Rogers and Huhndorf
- Roy, Anjali, and A. B. De** Taxonomy of *Daedalea roseola* comb. nov. 413-417
- Ryvarden, Leif** see Hattori and Ryvarden
- San Martin, Felipe** see Rogers, San Martin and Ju
- Shin, Hyeon-dong, and Uwe Braun** Notes on Korean Cercosporae and Allied Genera. 157-166
- Singh, Sanjay K., Ritesh K. Chaudhary and Gareth Morgan-Jones** Notes on Hyphomycetes. LXXI. Further Novel Leaf Spot-Inducing Species of *Phaeoramularia* from the Indian Subcontinent. 137-145
- Sipman, H.** see Rambold, Sipman and Hertel
- Thomas, C. M., and R. B. Bhat** New Report of Lichens from Southern Africa. 375-385
- Vánky, Kálmán, and Kirsten A. Websdane** New Ustilaginales on Cyperaceae from Australia. 167-183
- Walker, J.** see Alcorn and Walker
- Websdane, Kirsten A.** see Vánky and Websdane
- Wippel, Anita** see Mayrhofer, Matzer, Wippel and Elix
- Wu, Sheng-Hua** Studies on *Gloeocystidiellum* sensu lato (Basidiomycotina) in Taiwan. 1-68
- Zhurbenko, Mikhail** Lichens and Lichenicolous Fungi of the Northern Krasnoyarsk Territory, Central Siberia. 185-232

INDEX TO FUNGOUS AND LICHEN TAXA, VOLUME FIFTY-EIGHT

This index includes names of genera, infrageneric taxa, species, and infraspecific taxa.

New names are in **boldface**, and new names of suprageneric taxa, which are also included, are in **BOLDFACE CAPITALS**.

The page on which new taxa are proposed is in **boldface**.

- Abstoma 340
- Acanthobasidium 7
- Acanthophysellum 10
- Acanthophysium 7, 10
- Acarospora
 - fuscata 195
 - hospitans 195
 - molybdina 195
 - peliscypha 195
 - putoranica 195
 - rhizobola 185, 195
 - scabrida 185, 195
 - scyphulifera 195
 - smaragdula 195
 - veronensis 195
- Aglaospora
 - thelebola 467
- Agonimia
 - tristicula 185, 195
- Albatrellus 8
- Albugo 69, 71-73
 - centaurii 69-74
 - swertiae 69-74
- Alectoria
 - bicolor 196, 199
 - nigricans 196
 - ochroleuca 196
- Aleurobotrys 7
- Aleurocystidiellum 7
- Aleurodiscus 7, 10
- Allantoparmelia
 - alpicola 196
 - sibirica 196, 214
- Amandinea
 - coniops 196, 199
 - punctata 196, 199
- Amanita 357
- Amphisphaeria 349, 351, 419
 - arizonica 349
 - bufonia 349
 - foveata 349-350, 351**
 - multipunctata 349
 - pardalina 349
 - seriata 349-350, 351**
 - serrulata 349
 - striatispora 349
 - umbrina 349
- Amygdalaria
 - elegantior 196
 - panaeola 196
 - pelobotryon 196, 225
- Amylonotus 8
- Amylosporomyces 4, 8, 11
- Amylosporus 8
- Amylostereum 11
- Anapychia
 - bryorum 185, 196
 - ciliaris 185, 196
- Anomoporia 8
- Anthostoma
 - anserinum 451
 - fennicum 441-442, 457
 - ferrugineum 441
- Anthostomella 452
 - anserina 451
- Anzia 147-148, 153
 - sect. Nervosae 149
 - sect. Pannoparmelia 147
 - afromontana 147-150, 152-154
 - americana 149, 152
 - anzioides 153
- Anzina
 - carneonivea 185, 196
- Apiorhynchostoma
 - apiculata 452
 - curreyi 452
- Arachnion 331-332, 334, 336, 340
 - album 334, 336
 - aurantiacum 336
 - drummondii 334
 - iulii 331-332, 333-335**
 - lazoi 334
 - lloydianum 334
 - rufum 336
 - tener 334
- Arachniopsis 334
- Arctocetraria
 - andrejevii 196, 202
 - nigricascens 196, 202
- Arctomia
 - delicatula 196
 - interfixa 196
- Arctoparmelia 227
 - centrifuga 196
 - incurva 196
 - separata 196, 213, 227
 - subcentrifuga 185, 196
- Arctopeltis
 - thuleana 196, 208
- Arthonia
 - clemens 224
 - epiphyscia 224
 - excentrica 224
 - exilis 197
 - fuscopurpurea 224
 - glebosa 197, 222
 - linitae 224
 - molendoi 224

- [*Arthonia*] *peltigerea* 224
peltigerina 224
stereocaulina 224
- Arthrorhaphis*
alpina 197
citrinella 197
vacillans 197
- Aratomyces* 8-9
- Asahinea*
chrysantha 197
scholanderi 197
- Aspicilia* 225
alboradiata 197
alphoplaca 197, 211
anseris 197, 208
aquatica 197
caesiocinerea 197
calcarea 197
cinerea 197
contorta 197
cupreolata 197
disserpens 197
gibbosa 197
hoffmannii 197
hyperboreorum 197
laevata 197
lapponica 197
mastrucata 197
melanaspis 197, 211
perradiata 197, 209
phaeops 197, 210
plicigera 197
sublapponica 197
subplicigera 197
transbaicalica 197
- Asterina* 493
combreti 497
erysiphoides 495
inaequalis
var. nodulosa 496
leptalea 492
meliosmaticola 495
memorae 496
terminaliae 497
- Asterinella* 489, 491
argyreiae 489-490
hopea 497
- Asterosporium*
betulinum 462
- Asterostomella* 489
boehmeriae 489-491
helicteridis 489-490, 492
lepianthedis 489-490, 492
ligustri 489-490, 493
meliosmaticola 489, 494-495
radermacherae 489, 494-495
terminaliae 489, 494, 496
- Atelocauda* 328
- Auerswaldia* 464
- AURISCALPIOIDEAE** 1, 7-8
- Auriscalpium* 8-9
- Bacidia* 293-294
bagliettoana 197
herbarum 197
illudens 198
microcarpa 198, 212
pallens 198
sphaeroides 198
subfuscula 198
xylophila 198
- Baeomyces* 375, 383-384
carneus 198
placophyllus 198
rasens 380, 382
roseus 198, 206
rufus 198
- Battarrea*
phalloides 336, 338
- Bellemerea*
cinereorufescens 198
- Belonia*
russula 198
- Beltraminia* 293
- Beltraniella* 243, 246, 248
aethiopica 246, 249
amoena 243-244, 245-248
buloloensis 246, 249
clara 246, 248-249
clavatophora 243, 246-250
havanensis 246, 249
humicola 246, 249
japonica 246, 249
lyrata 246, 249
nilgirica 246, 248
ondinae 246, 249
peruamazonica 246, 249
pini 246, 248
pirozynskii 246, 248-249
porosa 246, 249
portoricensis 246, 248
spiralis 246, 249
- Biatora* 226-227
carnealbida 185, 198, 227
cuprea 198, 209
helvola 198, 209
pallens 198
sphaeroides 198
tetramera 198, 212
vernalis 198
- Biatorella*
contigua 198
coracina 198, 221
geophana 198, 221
hemisphaerica 185, 198
pruinosa 198, 220
- Bilimbia*
subfuscula 198
trisepta 198, 212
- Bispora*
christiansenii 224
- Boidinia* 4-5, 8, 14-15, 18, 21-22, 60-61
cana 1, 15-16, 62, 64
furfuracea 4, 15

- [Boidinia] **granulata** 1, 4, 15, 17-18, 62, 64
inconstans 1, 14, 60
 lacticolor 14
luteola 1, 15, 19, 62
macrospora 1, 4, 14-15, 20, 63-64
 peroxydata 14, 20
 propinqua 14, 16
 subasperispora 4, 15
- Botryosphaeria**
 collematoides 455
- Bovista** 334
- Brigantiaea**
 fuscolutea 198
- Brodoa**
 intestiniformis 199
 oroarctica 199, 207
- Bryocaulon**
 divergens 199
- Bryonora**
 castanea 199
 curvescens 199, 208
 rhypariza
 var. rhypariza 199
- Bryoria**
 bicolor 196, 199
 chalybeiformis 199
 fuscescens
 var. positiva 199
 lanestris 199
 nadvornikiana 199
 nitidula 199
 simplicior 199
- Buellia** 226, 264, 293-294
 aethalea 199
 alboatra 199
 arctica 199
 atrata 199, 213
 coniois 196, 199
 disciformis 199
 ectolechioides 199
 epipolia 199
 geophila 199
 insignis 199
 leptocline 199
 nivalis 199
 papillata 199
 pulverulenta 185, 199
 punctata 196, 199
 triphragmioides 199
- Calicium**
 salicinum 200
 trabinellum 200
 viride 200
- Calonectria** 123
 spathiphylli 124
- Caloplaca** 226-227
 abbreviata 200
 alcarum 200
 ammiospila 200, 226
 arctica 200-201
 arenaria 200
- borealis 200
 caesiorufella 200
 castellana 185, 200
 cerina 200, 227
 cinnamomea 200
 ssp. fulvo-testacea 200
 * (rank?) abbreviata 200
- epiphyta 200
 epithallina 200
 flavorubescens 200
 flavovirescens 200
 fraudans 200
 fulvotestacea 200
 holocarpa 200
 jenisejensis 200
 jungermanniae 200
 livida 200
 nivalis 200
 phaeocarpella 200
 saxicola 200, 217
 sibirica 200
 sinapisperma 200
 spitzbergensis 200
 stillicidiorum 200
 subolivacea 201
 tetraspora 201
 tetrasporella 201
 tirolensis 200-201
 tomoënsis 201
 vitellinula 201
- Camarops**
 ferruginea 441-442
- Candelaria**
 concolor 201
- Candelariella**
 aurella 201
 hudsonica 201
 kuusamoënsis 201
 placodizans 201, 224
 terrigena 201
 vitellina 201, 224
 xanthostigma 201
- Carbonea**
 vitellinaria 224
 vorticosa 201
- Castoreum** 340
- Catapyrenium**
 cinereum 201, 206
 daedaleum 201
 lachneum 201
 squamulosum 201, 205
- Catillaria**
 atropurpurea 201
 contristans 201
 hypochraea 201
 muscicola 201
 subnegans 201
- Catinaria**
 atropurpurea 201
- Catolechia**
 tenuis 304
 wahlenbergii 201

- Cercidospora
 epipolytropa 224
 lichenicola 224
 stereocaulorum 224
 ulothii 224
 Cercospora 157-158
 achyranthis 157
 adusta 157-158
 amurensis 162
 apii 158
 arachidicola 158
 arcti-ambrosiae 158
 aristolochiae-contortae 157-158, 159
 brassicicola 160-161
 calotropidis 142
 cannabis 163
 cardamines 160
 carotae 160
 chrysanthemi 160
 cichorii 160
 fukushiana 160
 ligustri 158
 ludwigiae 160
 nasturtii 160
 olivascens 160
 plucheae 142
 sesami 161
 sojina 163
 subhyalina 161
 Cercosporella
 virgaureae 161
 Cercosporidium 163
 sojinum 163
 Cetraria
 aculeata 202, 205
 andrejevii 196, 202
 ciliaris 202, 222
 commixta 202
 cucullata 202, 206
 delisei 202
 ericetorum 202
 ssp. ericetorum 202
 fastigiata 202
 hepatizon 202
 inermis 202
 islandica 202
 juniperina 202, 223
 lacunosa 202
 laevigata 202
 muricata 202, 205
 nigricans 202
 nigricascens 196, 202
 nivalis 202, 206
 odontella 202
 pinastri 202, 223
 sepincola 202, 222
 subtubulosa 202
 tilesii 202, 223
 Cetrariella
 delisei 202
 fastigiata 202
 Chaenotheca
 chrysocephala 202
 ferruginea 202
 furfuracea 202
 gracillima 202
 trichialis 202
 Chaenothecopsis
 nana 203
 pusilla 203
 viridialba 203
 Chapeckia
 nigrospora 462
 Chromatochlamys
 muscorum 203, 212
 Chromelosporium
 fulvum 355
 Chrysothrix
 chlorina 203
 Cladina
 arbuscula 203
 ssp. beringiana 203
 beringiana 203
 mitis 203
 rangiferina 203
 stellaris 203
 stygia 203
 Cladonia 226, 270, 286, 288
 acuminata 203
 alaskana 203
 amaurocraea 203
 bacillaris 203-204
 bacilliformis 203
 bellidiflora 203
 borealis 203-204
 botrytes 203
 cariosa 203
 carneola 203
 cenotea 203
 cervicornis
 ssp. verticillata 203, 205
 chlorophaea 203
 coccifera 204
 var. stemmatina 203-204
 coniocraea 204
 cornuta 204
 crispata 204
 cyanipes 204
 dahliana 204
 decorticata 204
 deformis 204
 digitata 204
 ecmocyna 204
 fimbriata 204
 floerkeana 204
 furcata 204
 gracilis 204
 ssp. elongata 204
 libifera 204
 luteoalba 204
 macilenta 203-204
 macroceras 204
 macrophylla 204
 maxima 204

- [Cladonia] merochlorophaea 204
 ochrochlora 204
 phyllophora 204
 pleurota 204
 pocillum 204
 pyxidata 204, 226
 squamosa 204
 stricta 204
 subfurcata 204
 subulata 204
 sulphurina 204
 symphycharpa 204
 thomsonii 204
 uncialis 205
 verticillata 203, 205
 Clavicornia 8-9, 11
 Clitocybe
 nebularis 390
 Coelocaulon
 aculeatum 202, 205
 muricatum 202, 205
 Collema
 arcticum 205
 ceranicum 205
 crispum 205
 cristatum 205
 dichotomum 205
 flaccidum 205
 fuscovirens 205
 minor 205
 polycarpon 205, 225
 tenax 205
 Collybia 357
 Colus
 hirudinosus 332
 Conferticium 3-5, 8, 14, 22, 24, 28
 heimii 1, 4, 22-24, 59, 62, 64
 insidiosum 26
 karstenii 26, 28
 ochraceum 1, 4, 22, 24-26, 28
 ravum 1, 4, 22, 24, 26-28, 63-64
 Coniothyrium
 insitivum 440
 Cordyceps 358
 Coriscium
 viride 205, 213
 Corticifraga
 peltigerae 225
 Corticium 2
 lactescens 55
 luridum 58
 luteocystidium 57
 ochraceum 24
 porosum 41
 ravum 26
 subasperisporum 4
 Cortinari 387, 393
 subg. Icterinula 393
 subg. Myxaciium 393
 subg. Phlegmacium 387-388
 subg. Sericeocybe 387, 392-393, 395
 subg. Telamonia 387, 395, 402
 albobrunnoides 390
 var. albobrunnoides 390
 var. violaceovelatus 387, 390, 407, 411
 albobolaceus 393, 407
 alnetorum 395, 408
 aureofulvus 391
 badiovinaceus 387, 399-400, 409
 balteatus 389
 belleri 401-404
 blattoi 388-389, 407, 410
 calopus 394-395
 canabarda 387, 397-399, 408
 f. coerulea 399
 chrysomallus 404
 coruscans 389-390
 durissimus 389
 emunctus 393
 evernius 396-397, 408
 fragrans 394-395
 fusisporus 401-403, 409
 glandicolor
 var. curtus 395-396
 griseolilacinus 393
 griseoviolaceus 387, 392-393, 407
 guttatus 391-392, 407
 heterosporus 402
 impennis 398
 impolitus 387, 400, 402-404, 409, 411
 incisus 387, 401-404
 ionema 387, 394, 408, 410, 412
 longisporus 402-403
 lucorum 398
 lux-nymphae 402
 nebularis 390
 nigrellus
 var. occidentalis 387, 399-400, 409
 percomis 391-392
 plumiger 397-399
 praestans 389
 psammocephalus 402
 pseudobalteatus 389-390
 rigidus 401, 403
 scobinaceus 402
 semivestitus 402-403
 strobilaceus 402
 sulfurinus 392
 umidicola 387, 397-399, 408
 Creolophus 8
 Creosphaeria
 sassafras 434
 Cryptodiaporthes
 salicella 455
 Cryptosphaeria
 eunomia
 var. fraxini 438
 Cryptospora
 bitorulosa 453
 Cryptovalsa 466
 ampelina 421
 Cyliandrocarpon 119, 126
 tenue 119-120
 Cyliandrocladiella 119-120, 123-124

- Cylindrocladium* 119-120, 123-124, 126
 intermedium 120
 ovatum 123, 126
 parasiticum 126
 pteridis 126
 spathiphylli 119, 123-126
 variabile 126
- Cyphelium*
 karelicum 205
 pinicola 185, 205
 tigillare 205
- Cystopus*
 centaurii 70-71
 convolvulacearum
 var. swertiae 71
 swertiae 70-71
 tragopogonis
 f. swertiae 71
- Cytoplea* 447
 insitiva 440
 verrucispora 447
- Cytospora* 423-424, 426, 429, 437, 440
- Dacampia*
 hookeri 225, 227
- Dactylaria* 253-254, 258
 filiformis 253-254, 255-256
 obclavata 253-254, 256-258
 scolecospora 254
- Dactylina*
 arctica 205
 beringica 205
 madreporeiformis 205
 ramulosa 205
- Dactylospora*
 deminuta 225
 glaucomarioides 225
 parasitica 225
 pertusariicola 225
 purpurascens 225
 saxatilis 225
- Daedalea* 416
 roseola 413, 415
 quercina 416
- Dentipellis* 8
- Dentipratulum* 8-9
- Dermatocarpella*
 squamosum 201, 205
- Dermatocarpon* 225
 intestiniforme 205
 luridum 205
 miniaturum 205
 rivulorum 205
 vellereum
 var. vellereum 205
- Diaporthe* 421
 bambusae 443
 bitorulosa 453
 eres 466
 fulvopruinata 426, 457
 pustulata 457
 saroathamni 465
 thelebola 467
- Diatrype*
 aethiops 431, 434, 451
 angularis 451
 cincta 430, 453
 exasperans 427, 457
 insitiva 421
 moroides 441-442, 461
 nigrospora 462
 obesa 429
 pustulans 448-449, 464
 quadrata 427, 429, 464
 viticola 431, 434-435, 468
- Dibaeis*
 baeomyces 198, 206
- Didymellopsis*
 collematum 225
- Didymosphaeria* 419, 443, 460
 minutella 448-449
 oblitescens 451
 phylllostachydis 448-449
 scabrispora 449
 serrulata 443
 sphaerophora 465
 striatula 447-448
- Dimelaena* 293-296, 300
 australiensis 293-295, 297, 299-300, 306
 diffractella 293-294, 305
 elevata 293-296, 298, 300, 302
 oreina 293-295, 302-304
 somalienensis 293, 305
 tenuis 293-297, 299, 304-306, 308
 thysanota 294
- Diplodia*
 mutila 457
- Diploschistes* 269, 271, 277, 283, 289
 actinostomus 270-273, 279
 var. aeneus 273
 aeneus 270-271, 273-275
 albornii 269, 279-280
 austroafricanus 269-271, 273-274
 badius 273
 bisporus 269
 caesioplumbeus 272, 279
 chloroleucus 269, 276
 cinereocaesius 269, 272, 275-278, 284
 compositus 269, 276
 diacapsis 291
 diploschistoides 269-270, 272, 277, 279-280
 euganeus 270, 275, 277, 281-282, 290
 hensseniae 269-270, 282-284
 hypoleucus 269-270, 283-285
 isabellinus 272, 276, 283, 285
 lutescens 269, 276
 muscorum 206, 286
 ssp. bartlettii 270, 276, 283, 286, 288
 ssp. muscorum 286
 ocellatus 270, 285, 287, 289
 f. isabellinus 269, 276
 rampoddensis 276
 scruposus 206, 272, 287-289, 378, 383

- [*Diploschistes*] *sticticus* 270, 288-290
 subfarinaceus 269, 276
 thelenelloides 282
 thunbergianus 270, 288-289, 291
- Dirinaria*
 picta 382
- Dothidea* 458
 haraeana 458
 hysterioides 446
 rudis 431, 433, 465
 tubaraeensis 468
- Dothidothia*
 andersonii 467
- Dothivalsaria*
 megalospora 450-451, 461
- Echidnodella* 489
 dipteroearpi 497
 hopeae 489, 494, **497**
- Echinodontium* 11
- Echinothecium*
 reticulatum 225
- Eiglera*
 flavida 206, 208
- Endocarpon*
 pusillum 206
- Endococcus*
 gyrophorarum 225
 perpusillum 225
 propinquus 225
 rugulosus 225
- Endopyrenium*
 hepaticum 201, 206
- Endoxyla*
 parallela 462
- Endoxylina* 419-420, 438, 450-451
 allantospora 420, 439, 441, 451, 455
 anserina 451
 astroidea 438-439, 466
 moroides 441, 461
 stellulata 438, 466
- Entonaema* 483, 486
 cinnabarina 486
 globosum 483, 486
 f. aurantia 486
- Entosordaria*
 apiculata 452
- Epilichen*
 scabrosus 206
- Eudarluka*
 australis 453
- Euopsis*
 granatina 206
 pulvinata 206
- Eutypa* 434-435, 438
 astroidea 438
 viticola 434
- Eutypella* 468
- Evernia*
 mesomorpha 206
 perfragilis 206, 226
- Exophiala* 423
- Farnoldia*
 jurana 206
- Fenestella* 420
- Flavocetraria*
 cucullata 202, 206
 nivalis 202, 206
- Foraminella*
 ambigua 206, 214
 hyperopta 206, 214
- Fuckelia*
 insidens 459
- Fulgensia*
 bracteata 206
 var. alpina 206
- Fusarium* 126
- Gastrocybe*
 lateritia 331
- Geastrum* 336, 338, 340
 morganii 332
- Geltingia*
 associata 225
- Geneosperma* 238
- Geniculosporium* 483
- Gibbera*
 andersonii 467
- Gliocladiopsis* 119-121, 123-124
 irregularis 119-120, 121-122
 sagariensis 119
 tenuis 119-121, 126
- Gloeocystidiellum* 1-8, 10-14, 22, 28-29, 31, 47, 57, 59-60
 aculeatum 1, 29-30, 62, 64
 aspellum 1, 29, 31-32, 37, 59, 63, 65
 citrinum 2-3, 5
 clavuligerum 43
 compactum 1, 29, 33-35, 37, 47, 62, 65
 convolvens 2, 5-6, 31, 40
 fimbriatum 40-41
 flammeum 4-5
 formosanum 1, 29, 35, 37, 47, 62, 65
 furfuraceum 2, 4-5
 heimii 4-5, 22-23
 inconstans 60
 kenyense 45
 lactescens 2-3, 5-7, 55
 laxum 1, 29, 31, 37, 39-40, 63, 65
 luridum 2-3, 58
 var. microsporum 6
 luteocystidiatum 57
 luteocystidium
 var. brevisporum 6
 moniliforme 1, 29, 40-41, 63
 ochraceum 2-3, 5, 24
 odontoideum 31
 orientale 6, 52
 porosum 1-2, 5, 29, 41, 43, 63
 purpureum 1, 29, 44-45, 63, 65
 tabacinum 1, 29, 45-47, 63
 wakullum 61
 zawitense 51-52
- Gloeocystidiopsis* 4-5

[Gloeocystidiopsis] heimii 22

Gloeocystidium 2

sect. Amyloidea 2

sect. Ceracea 2

sect. Insidiosa 2

exsudans 2

friesii 24, 26

guttuliferum 2

karstenii 26

lactescens 55

luridum 58

ochraceum 24

porosum 41

Gloeodontia 8-9

columbiensis 9

discolor 9

Gloeohypochnicium 11

Gloeomyces 1, 5, 8, 13, 47-48, 60

ginnsii 1, 48-49

graminicola 1, 47-48, 49-51, 65

Gloiodon 8-9

Gloiothele 3, 5-6, 8, 14, 48, 51-52

citrina 3, 6, 52, 54

citrinoidea 1, 6, 52-54

globosa 1, 52, 54

granulosa 52

lactescens 6-7, 52, 55-57

lamellosa 3, 31, 52

tropicalis 52

turpis 52

zawitense 1, 52

Gyalecta

arctica 206-207

foveolaris 206

geioca 206

kukriensis 185, 206

peziza 206

thunbergiana 291

Gyalidea

scutellaris 206-207

Gypsoplaca 185, 207

Gyrophragmium

dunalii 331

Haematomma 260

subpuniceum 260

ventosum 207, 213

Hafellnera

parasemella 207, 210

Haplosporella

insitiva 440

Helocarpon

crassipes 207, 212

Heppia

lutosa 207

Hercospora

tiliae 467

HERICIOIDEAE 1, 8

Heridium 8-9

Heterobasidion 8

Heterodermia

diademata 383

leucomela 380

speciosa 378, 380

Hormonema 423-424, 426, 429

Huilia

flavocaerulescens 207, 217

Humariella

pseudotrechispora 238

Hygrophorus

agathosmus 390

Hymenelia

lacustris 207

Hyperphyscia

syncolla 380, 382

Hyphodontia 5

Hyphozyma 423

Hypocenomyce

scalaris 207

Hypocreopsis 422, 463

endoleuca 456

hypoxylodes 436, 459

peziziformis 463

Hypogymnia

austerodes 207

bitteri 207

oroarctica 199, 207

physodes 207

subobscura 207

vittata 207

Hyponectria 460

Hypoxylon 455, 458

beaumontii 453

gemmatum 435, 437, 457

gregale 458

insidens 459

nudicolle 462

perforatum 455

rubricosum 435-436, 465

walterianum 435, 437

Hypoxylonopsis 419, 422, 424

hurae 422-424, 436, 438, 458

rehmiana 436, 464

Hypsostroma 454

Icmadophila

ericetorum 207

Illosporium

carneum 225

Immersaria

athrocarpa 185, 207

Immotitia

atrograna 455, 458-459, 467

Imshaugia

aleurites 207, 214

Ionaspis

cyanocarpa 207

epulotica 207

[Ionaspis] rhodopis 207

Jahnoporus 8

Japewia

tornøensis 208, 210

Kernkampella 328
 Knightiella
 splachnirima 323

Lachnea
 torrentis 238
 Lasiosphaeriopsis
 stereocaulicola 225
 Lasmeniella 466
 Laurilia 11
 Laxitextum 7-8
 Lecania
 cyrtella 208
 Lecanora 224, 226
 albella 260
 albescens
 f. deminuta 208
 allophana 208
 anopta 208
 anseris 197, 208
 argentata 208, 259-261
 atrosulphurea 208
 beringii 208
 bicincta 208
 boligera 208
 californica 261
 campestris 208
 cavicola 185
 cenisia 208
 chlorophaeodes 208
 contractula 208
 var. feracissima 196, 208
 crenulata 208
 curvescens 199, 208
 dispersa 208, 226, 261
 elapheia 261-262
 epibryon 208, 225-226, 262
 ssp. broccha 262
 expallens 208
 farinacea 262, 264
 flavida 206, 208
 frustulosa 208
 fuscescens 208
 geophila 208, 224
 glaucolivida 265
 grantii 259, 264-265
 gyrophorina 208
 hagenii 208, 226
 var. saxifragae 208
 intricata 208
 laevis 262
 leptacinella 262
 lisbonensis 262
 margarodes 263
 marginata 208, 210
 mayrhoferi 263
 mughicola 185, 208
 nephaea 208, 218
 oleae 261
 orae-frigidae 208
 oreina 294
 pachysoma 261

palestinica 262
 pallida 260
 perradiata 197, 209
 plumosa 264
 polytropa 209, 224, 226
 praepostera 263
 proserpens 209
 pseudogangaleoides 263
 pulicaris 209
 queenslandica 264
 rosulata 209
 rugosa
 var. subrugosa 261
 rugosella
 var. subrugosa 261
 rupicola 209
 saligna 209
 schistina 263
 sienae 261-262
 straminea 209
 subfusca 209
 subintricata 209
 submellea 209
 subrugosa 209, 259, 261
 sulphurea 185, 209, 226
 torrida 209
 varia 209
 vegae 209
 wilsonii 264
 xylophila 259, 264-265
 Lecidea 226, 321
 albohyalina 209
 arctogena 209, 222
 atrobrunnea 209, 322
 atrofusca 209, 212
 auriculata 209
 berengeriana 209, 212
 botryosa 209
 brachyspora
 var. chatangensis 209
 caesioatra 209
 confluens 209
 cuprea 198, 209
 diducens 209
 ementiens 209
 epiphaea 209
 epixanthoidiza 209
 fallax 209
 garovaglii 209, 212
 goniophila 209-210
 gorodkovii 209
 helvola 198, 209
 hypnorum 209, 212
 hypopta 209
 instrata 209, 212
 lactea 209
 lapidica 209
 limosa 209
 lurida 210, 218
 macrocarpa
 f. praetoria 210
 marginata 208, 210

- [Lecidea] miscella 210
 - pallida 210, 216
 - phaeops 197, 210
 - ramulosa 210
 - recessa 210
 - septentrionalis 210
 - subcandida 210
 - sublimosa 210
 - tajmyrensis 210
 - tessellata 210
 - tornoënsis 208, 210
 - turficola 210
 - turgidula 210
- Lecidella 226
 - carpathica 210
 - elaeochroma 210
 - euphorea 210
 - glomerulosa 210
 - parasemella 207, 210
 - stigmatea 209-210
 - wulfenii 210
- Lecidoma
 - demissum 210
- Leciophysma
 - finmarkicum 210
- Lentinellus 7-9
 - cochleatus 9
- Lepiota 357
- Lepraria 224, 226
 - arctica 210
 - membranacea 210
 - neglecta 210
- Leproloma
 - membranaceum 210
 - vouauxii 210
- Leptogium
 - arcticum 210
 - coralloideum 380, 382
 - crenatulum 211
 - cyanescens 378
 - gelatinosum 211
 - lichenoides 211
 - phyllocarpum 380, 382
 - saturninum 211
 - sinuatum 211
 - subtile 211
 - tenuissimum 211
- Lichen
 - cinereocaesius 275
 - excavatus 291
 - ocellatus 287
 - scruposus 287
- Lichenoconium
 - lecanorae 226
- Limboria
 - euganea 281
- Lindquistia 485
- Llimoniella
 - neglecta 226
- Lloydella 365
- Lobaria
 - linita 211, 224
- Lobothallia
 - alphoplaca 197, 211
 - melanaspis 197, 211
 - radiosa 211, 217
- Lojkania
 - melasperma 454
- Lopadium
 - coralloideum 211, 225
 - fecundum 211, 220
 - pezizoideum 211
- Lopadostoma
 - apiculatum 452
- Lopharia 10
- Lycoperdon 359
 - lividum 332
- Macrovalsaria
 - leonensis 461
 - megalospora 461, 466
- Massariovalsa 461, 463
 - californica 461
 - megalospora 461
 - sudans 450, 452, 466
- Megalocystidium 3, 5-6, 14, 57-58
 - lactescens 55
 - leucoxanthum 3, 57-59
 - luridum 1, 3, 5-6, 58
 - luteocystidium 1, 57-58**
 - montanum 57-59
- Megaspora
 - verrucosa 211, 213, 225
- Melanconiella
 - nigrospora 462
- Melanconis 453
 - bitorulosa 453
 - chrysostroma 453
 - nigrospora 462
 - thelebola 467
- Melanelia
 - disjuncta 211, 214
 - infumata 211, 226
 - olivacea 211
 - panniformis 211
 - septentrionalis 211
 - sorediata 211
 - stygia 211, 214
 - tominii 211, 214
- Melanomma
 - subdispersum 344
- Melastiziella 238
- Melogramma 468
 - actidia 450
 - cinnamomi 423, 435, 437, 454
 - eucalypti 435, 437, 457
 - gemmata 435, 457
 - grandinea 457-458
 - hookeri 458
 - insidens 458-459
 - phoradendri 464
 - rubricosum 433, 435, 465
- Merismatium
 - coccisporum 226

[Merismatium] decolorans 226
 heterophractum 226
 Mesophellia 340
 Mesophelliopsis 340
 pernambucensis 340
 Micarea
 assimilata
 var. infusca 211
 crassipes 207, 212
 incrassata 212
 melaena 212
 osloënsis 212
 peliocarpa 198, 212
 turfosa 212
 Microcalicium
 parietinum 212
 Microglaena
 leucothelia 212, 218
 muscorum 203, 212
 reducta 212, 218
 sphinctrinoides 218
 Miriquidica 319, 323
 deusta 319, 322
 garovaglii 209, 212, 322
 instrata 209, 212
 leucophaea 319
 lulensis 212
mexicana 319-320, 321-323
 ventosa 323
 Morganella 336, 338
 Mucronella 8-9, 11
 Muellerella
 hospitans 226
 lichenicola 226
 pygmaea 226
 Mycenastrum 334
 Mycobilimbia
 berengeriana 209, 212, 227
 hypnorum 209, 212
 lobulata 212, 222, 225
 microcarpa 198, 212
 obscurata 198, 212
 sabuletorum 212
 Mycoblastus
 affinis 212
 alpinus 212
 sanguinarius 212
 Mycocalicium
 parietinum 212
 subtile 212
 Mycovellosiella
 ferruginea 161
 Myrmaeciella 422
 endoleuca 422, 456
 hohneliana 458
 Myrmaecium 419, 422-423, 450
 abietinum 435, 450
 cannae 453
 cinctum 430, 454
 decorticans 455
 durissimum 422, 435-436, 456
 endoleucum 456

endophaeum 457
 fraxineum 457
 harperianum 458
 hohneliana 458
 hookeri 458
 hypoxloides 436, 458
 insidens 459
 insitivum 422, 430, 459
 lophiostomum 468
 megalosporum 461
 milletiae 468
 muroianum 462
 penicillariae 463
 quadratum 427, 464
 rubricosum 422, 424, 435, 465

Nectria
 subsect. Dialonectria 123
 atrofusca 452
 Nectriella 453
 Nemanja 453
 Neofuscelia
 pulla 212, 214
 Neoramularia 162
koreana 157, 161-162
 Nephroma
 arcticum 213
 expallidum 213
 parile 213
 resupinatum 213
 Nesolechia
 oxyspora 226
 Nidulariopsis
 iowensis 332
 Niebla
 homalea 261
 Normandina
 pulchella 213
 Nyssopsora 328
 Ochrolechia 225-227
 androgyna 213, 225, 227
 arborea 213
 frigida 213, 225-227
 gonatodes 213
 grimmiae 213
 gyalectina 213
 inaequatula 213
 lapuënsis 213
 upsaliensis 213, 225-227
 Omphalina
 hudsoniana 205, 213, 216
 Ophioparma
 ventosa 207, 213
 var. lapponica 213
 Orphniospora
 moriopsis 199, 213
 Pachyospora
 verrucosa 211, 213
 Pannaria
 crustata 264

- [Pannaria] leucophaea 213
 pezizoides 213, 224-225
 praetermissa 213
 Pannoparmelia 147-148, 153
 anzioides 153
 Paraporpidia
 leptocarpa 262
 Parmelia
 andina 378, 383
 austerosinensis 378
 birulae 196, 213
 disjuncta 211, 214
 fraudans 214
 nigra 196, 214
 omphalodes 214, 225-226
 ssp. glacialis 214
 pilosa 378, 380
 pulla 212, 214
 reticulata 380
 saxatilis 88, 214, 226
 sooredians 383
 stenophylla 214, 223
 stygia 211, 214
 substygia 211, 214
 sulcata 214, 226
 taractica 214, 223
 teretiusscula 211, 214
 tominii 211, 214
 Parmeliella
 arctophila 214
 triptophylla 214
 Parmeliopsis
 aleurites 207, 214
 ambigua 206, 214
 hyperopta 206, 214
 Passalora 162-163
 amurensis 162
 depressa 162
 sojina 163
 Peltigera 226-227
 aphthosa 214, 224, 227
 canina 214, 225
 didactyla 214-215, 226
 elisabethae 185, 214
 frippii 185, 214
 horizontalis 214
 kristinssonii 185, 214
 lepidophora 214
 leucophlebia 214
 malacea 215, 224
 neckeri 215
 polydactylon 215
 rufescens 215, 224-225, 227
 scabrosa 215
 spuria 214-215
 venosa 215
 Peniophora 2, 5
 inconstans 60
 Peronospora 313-314, 317
 agrimoniae 314
 alchemillae 314
 farinosa 317
 fragariae 314
 hysocyami 317
 potentillae 313-314
 potentillae-reptantis 314
 rubi 314, 317
 sanguisorbae 314
 schachtii 317
 sparsa 313-317
 tabacina 317
 Pertusaria 226-227
 amara
 var. flotowiana 215
 bryontha 215
 bryophaga
 var. robustior 215
 christae 185, 215
 corallina 215
 coriacea 215
 dactylina 215, 220
 diffusilis 215
 excludens 215, 225
 geminipara 215
 globulata 215
 glomerata 215
 lactea 215
 lophocarpa 262
 octomela 215
 oculata 215
 panyrga 215
 rupestris 215, 225
 solitaria 215, 225
 subdactylina 215
 subobducens 215
 trachydactyla 215
 trochiscea 216
 Peziza
 badioconfusa 233-234
 geneospora 234
 Pezizella
 epithallina 226
 Phacopsis
 oxyspora 226
 Phaedothis
 gigantochloae 448
 Phaeocalicium
 compressulum 216
 praecedens 216
 Phaeocreopsis 419, 422, 424, 450
 hypoxylodes 422, 424, 436-437, 459
 pezizaeformis 463
 Phaeoisariopsis
 pyricola 144
 Phaeophyscia
 constipata 216
 endococcina 216
 hirsuta 383
 hispidula 216
 kairamoi 216
 nigricans 216
 sciastra 216
 Phaeoramularia 137, 142, 144, 163
 acericola 140

- [Phaeoramularia] **calotropicola** 137, **140-142**
 calotropidis 142
ficina 137-**138**, 139-140
 helianthi 140
 leptadeniae 140, 142
 meridiana 140
 perulariae 142
 plucheae 142
 pruni 144
 pyricola 144
pyrigena 137, **142-144**
 weigelaiae 163
weigelicola **163**
- Phaeorrhiza
 nimbose 216
 sareptana 216
- Phaeosperma 452
 anserinum 451
 cariei 454
 fennica 441, 457
 foedans 441-442, 457
 niesslii 441, 462
 saccardianum 465
- Phaeospora
 peltigericola 226
- Phaeosporobolus
 alpinus 226
 usneae 226
- Phellinus 129, 133
 cinchonensis 133
 contiguus 135
 cylindrosporus 133
 ferreus 133
 lamaensis 135
macroferreus 129-**131**, 132-133
 palmicola 133, 135
 rufitinctus 135
 tawhai 133
velutinus 129, **131**, 133-135
- Phylloporthe 463
 orbiculata 463
- Physcia
 aipolia
 var. *alnophila* 216
 albinea 216
 caesia 216, 224
 dubia 216
 phaea 216
 stellaris 216
 tribacia 216
 wainioi 216
- Physconia
 deterosa 216
 muscigena 216
 perisidiosa 216
- Phytoconis
 viridis 213, 216
- Phytophthora 93-102
 boehmeriae 95, 97, 99-100
 botryosa 98-99
 cactorum 97-99
 capsici 94, 96-100
 cinnamomi 98-99, 102-103
 citricola 97-99
 citrophthora 94, 97-99
 colocasiae 94, 98-99, 102
 cryptogea 98-99
 cyperi 98-99
 drechsleri 95-96, 98-99, 102
 fragariae 99
 var. *oryzo-bladis* 95, 99, 101
 gonapodydes 99
 heveae 98
 infestans 93-95, 99-100
 meadii 98-99
 megasperma 99-100
 var. *sojae* 99
 melongenae 94, 99
 melonis 96-97, 99
 nicotianae 98-99, 101
 var. *parasitica* 97
 palmivora 97-99
 parasitica 94, 96-97, 99
 var. *nicotianae* 97, 99
 porri 98-99
 richardiae 98-99
 robinicola 98-99, 101
 sinensis 96, 99
 sojae 99-100
 vignae 98-99
- Pilophorus
 cereolus 216
 dovrensis 210, 216
 pallidus 216
 robustus 217
- Placidiopsis
 cervinula 217
- Placodium
 circinatum 211, 217
 elegans 217, 224
 fruticulosum 217, 224
 murorum 200, 217
- Placopsis
 gelida 217
- Placynthiella
 uliginosa 217
- Placynthium
 asperellum 217
 nigrum 217
- Pleospora
 engeliana 226
- Pleurocytospora
 vestita 420
- Plowrightia
 symphoricarpi 467
- Podosordaria 483, 485
 hircina 485
 mexicana 485
- Polyblastia
 bryophila 217
 gelatinosa 217
 gothica 217
 hyperborea 217
 melaspora 217

- [Polyblastia] nigrata 217
 scotinospora 217
 sendtneri 217
 terestris 217
 theleodes 217
- Polychidium
 muscicola 217
- Polycoccum
 bryonothae 226
 tryptelioides 227
- Polyporus
 rubriporus 133
 torulosus 133
- Porina
 mammillosa 217
- Poronia 485
- Porpidia 225
 albocaerulescens 217
 cinereoatra 217
 crustulata 217, 264
 flavocaerulescens 217
 macrocarpa 217
 melinodes 207, 217, 225
 speirea 217
 superba 218
 tuberculosa 185, 218
- Pronectria
 solorinae 227
- Prosthecium 463
 appendiculatum 461, 464
- Protoblastenia
 siebenhaariana 218
 terricola 218, 227
- Protoparmelia 265
 badia 218
 montagnei 265
 nephaea 208, 218
- Protothelenella
 leucothelia 212, 218
 sphinctrinoidella 212, 218
 sphinctrinoides 218
- Psalliota 357
- Pseudephebe
 minuscula 218
 pubescens 218
- Pseudocercospora
 araliae 163
 cannabina 163
 cantuariensis 163
 chengtuenensis 164
 cydoniae 164
 fukuokaensis 164
 ligustri 158
 nojimae 164
 puderi 164
 rubi
 var. subhyalina 164
- Pseudocercosporiella
 capsellae 165
 inconspicua 165
- Pseudocolus
 fusiformis 331
- Pseudospiropes 343-344
 dumeti 343-346
 elaeidis 344
 falcatus 344
 hughesii 344
 leptotrichus 344
 lоторum 344
 navicularis 344
 novae-zelandiae 344
 obscurus 344
 pinarensis 344
 rousselianus 344
 subuliferus 344
 variabilis 344
 verruculosus 344
- Pseudothis
 coccodes 443, 466
 subcoccodes 466
- Pseudothyridaria 419-420, 439, 450
 insitiva 439-440, 463
- Pseudovalsa 456
 apatosa 452
 bignoniae 453
 caproni 454
 celtidis 431, 454
 clethraecola 431, 455
 complexa 455
 donacina 456
 durissima 435, 456
 foedans 441, 457
 fulvopruinata 426, 457
 kunzeana 427, 460
 majuscula 461
 megalosporum 461
 melastroma 461
 niesslii 441, 462
 nigrofacta 431, 462
 notarisi 430, 462
 oleifera 463
 parmularia 463
 peckii 442, 463
 phlyctaenodes 430, 464
 purpurascens 464
- Pseudovalsaria 419-420, 440-441, 450
 allantospora 439-440, 451
 ferruginea 419-420, 440-443, 452, 457,
 461-462, 465
 foedans 420, 440-442, 457
 peckii 442, 463
- Pseudovalsella
 thelebola 467
- Pseudoxenasma 8
- Psora
 decipiens 218
 globifera 218
 lurida 210, 218
 rubiformis 218, 227
- Psoroma
 hypnorum 218
- Psorula
 rufonigra 218

- Puccinia*
 levis
 var. *levis* 328
Punctelia 77
 colombiana 77-80, 82, 84, 86, 88, 90
 hypoleucites 77
 jujensis 77, 90
 microsticta 77
 nebulata 77
 negata 77
 novozelandica 77
 stictica 77-78, 84, 86, 88, 90
 subalbicans 77
Pyricularia 344
Pyriculariopsis 344
Pyrhospora 265
 laeta 265
Pythium 101
 oligandrum 100

Radiigera 331, 338, 340
 atrogloba 338, 340
 fuscogloba 340
 piggarii 338
 romana 331, 336-340
Ramalina
 almquistii 218
 capitata 218
 celastri 383
Ramalinora 265
 glaucolvida 265
Ramboldia 265
 stuartii 265
Ramularia 161-162
 archangelicae 165
 armoraciae 165
 cynarae 165
 plantaginis 165
 pratensis 165
 rubella 165
 weigeliae 163
Ravenelia 325, 328
Rhexophiale
 coronata 218
Rhizocarpon 225
 alpicola 218
 amphibium 218
 badioatrum 218
 copelandii 218
 disporum 218
 eupetraeoides 219
 eupetraeum 219
 expallescens 219
 frigidum 219
 geminatum 219
 geographicum 219
 grande 219
 hochstetteri 219
 jemtlandicum 219
 macrosporum 219
 obscuratum 219
 orphaninum 219
 polycarpum 219
 rittokense 219
 saanaense 219
 simillimum 219
 viridiatrum 219
Rhizopla
 chrysoleuca 219
 melanophthalma 219
 peltata 219
Rhopoglyphus
 hysterioides 446
Rhynchostoma
 anserina 451
 apiculatum 452
 julii
 f. *vestitum* 454
Rinodina 293, 305
 archaea 219
 archaeoides 219
 arctica 219
 bischoffii 219
 cacuminum 219
 cinnamomea 219
 confragosa 219
 diffractella 305
 exigua 219
 lecideoides 219
 mnariae 219
 var. *cinnamomea* 219
 var. *mnariaeiza* 219
 muelleri 305
 olivaceobrunnea 219-220
 oreina 294
 var. *fimbriata* 294
 parasitica 185, 219
 parvula 219
 physciaeformis 305
 roscida 220
 septentrionalis 220
 sophodes 220
 soredicola 219-220
 subobscura 220
 teichophila 220
 tenuis 305
 turfacea 220, 225
Ropalospora
 lugubris 219
Roussoella 419-420, 443-445, 449-450, 475
 alveolata 419, 443-444, 445, 447, 449, 475
 amphigena 443
 bambusae 443
 bauhiniae 443
 chilensis 419, 443-445, 454, 475
 donacicola 419, 443-445, 446-447, 456, 475
 hysterioides 443-448, 475
 var. *minuta* 443
 intermedia 419, 443-444, 447, 448, 475
 minutella 443, 446, 448-449
 munkii 443
 nitidula 443-444, 446

- [Roussoella] phyllostachydis 443, 448
pustulans 419, 443-444, 446-**448**, 449, 464, 475
 scabrispora 443-445, 449, 475
 serrulata 443
 subcoccodes 443, 466
 verruculosa 443, 449, 446
- Sagiolechia
 rhexoblephara 218, 220
- Sarawakus 463
- Sarcogyne
 privigna 220
 regularis 198, 220
- Schadonia
 fecunda 211, 220
- Schaereria 323
 cinereorufa 220
 fuscocinerea 220
 tenebrosa 220
- Scoleciocarpus 334
- Scoliciosporum
 umbrinum 220
- Scutellinia 233-234, 238
 sect. Geneospermae 238
 sect. Minutae 238-239
 sect. Pseudotrechisporae 238
 ser. Pseudotrechisporae 238
 ahmadii 238
 ceipii 239
 crinita 239
 crucipila 239
 geneospora 233-234, 237, 240
 marginata 239
 nigrohirtula 239
 olivascens 239
 phymatodeus 233, 238
 pseudotrechispora 238
 scutellata 238
 torrentis 239
totaranuiensis **233**, 235-236, 238, 240
- Scutula
 stereocaulorum 227
- Scytinostromella 8, 14
- Siphula
 ceratites
 var. major 220
 delicata 220
- Solorina 224
 bispora 220, 226
 crocea 220
 octospora 220
 saccata 220, 224, 226
 spongiosa 220, 226-227
- Sphaerellothecium
 araneosum 227
- Sphaeria 421
 anserina 451-452
 apiculata 452
 astroidea 438
 atrofusca 452-453
 bignoniae 453
 cincta 430, 454
 collematoides 455
 curreyi 452
 decorticans 426, 429-430, 455-456
 diospyri 456
 donacina 456
 fulvopruinata 426, 428-430, 457
 gemmata 435, 437
 gleditschiae 457
 grandinea 457-458
 gregalis 458
 insidens 459
 insitiva 421-422, 430, 433, 459
 melastroma 461
 notarisii 430, 432, 462
 var. lanceolata 432
 nudicollis 462
 obesa 426, 428-429
 periplocae 430, 433, 463
 phlyctaenodes 430, 432, 464
 phoradendri 464
 purpurascens 464
 robiniae 421, 430, 434, 464
 rubricosa 435-437, 465
 spurca 466
 thelebola 467
 tiliae 467
 toxici 467-468
 viticola 431, 434, 468
- Sphaerophorus
 fragilis 220
 globosus 221
- Sphaerophragmium 325, 328-329
 acaciae 328-329
 albiziae 326
 artabotrydis 328
 boanense 328
 debile 328
 evernium 326
 irregulare 326
 mucunae 326
 parkiae 326
quadricellulare **325-329**
 silveirae 326
- Sphaeropsis 457
 malorum 457
- Spiropes 344
- Sporastatia
 polyspora 221
 testudinea 198, 221
- Spumula 328
 debilis 328
- Staurothele
 fissa 221
- Stecchericium 8
- Steinia
 geophana 198, 221
- Stereocaulon 224, 227
 alpinum 221, 224, 227
 apocalypticum 221
 arcticum 221
 arenarium 221

- [Stereocaulon] botryosum 221, 225
 capitellatum 221
 condensatum 221
 denudatum 221
 depressum 221
 glareosum 221
 grande 221
 groenlandicum 221
 incrustatum 221
 paschale 221
 rivulorum 221, 224, 227
 sibiricum 221
 spathuliferum
 f. dissolutum 221
 subcoralloides 221
 symphycheilum 221
 tomentosum 221
 vesuvianum 221
- Stereum 8, 10, 61
 wakullum 1, 10, 61
- Sticta
 arctica 221
- Stigmidium
 cerinae 227
 conspurcans 227
 frigidum 227
 peltideae 227
 pseudopeltideae 227
 schaereri 227
 solorinae 227
- Taleola
 thelebola 467
- Teloschistes
 contortuplicatus 185, 221
- Tephromela
 aglaea 222
 atra 222, 262
 testaceoatra 209, 222
- Thamnia
 vermicularis 222
 var. subuliformis 222, 225, 227
 var. vermicularis 227
- Thelephora
 citrina 2-3
 lactescens 3, 55
 ochracea 24
- Thelidium
 papulare 222
 sordidum 222
- Thelocarpon
 epibolum 185, 222
 tichomirovii 222
- Thelomma
 mammosum 261
 ocellatum 185, 222
- Thelopsis
 melathelia 222
- Thelotrema
 diploschistoides 279
 microglaenoides 279-280
- Thrombium
 epigaeum 222
- Thuemenella
 cubispora 466
- Thyridaria
 fraxini 438
- Thyridium 420
 vestitum 420
- Tolyposporium 167, 169, 172, 175, 183
 aterrimum 183
 caustidis 167, 177-179, 183
 cyathochaetae 167, 180-183
 evandrae 167, 172, 175-176, 178, 183
 fischeri 183
 junci 169
 kochianum 183
 laevigatum 183
 lepidospermae 183
 littorale 183
 mauritianum 183
 melanosporum 167, 170, 172, 174-175, 180, 183
 mesomelaenae 167-169, 170, 183
 muellerianum 183
 rhynchosporae 183
 rhynchosporae-cephalotis 183
 rodwayi 183
 schoeni 183
 tricolulariae 167, 178, 181-183
- Toninia 375, 384
 aromatica 222
 bumamma 380, 382
 cumulata 22
 groenlandica 197, 222
 lobulata 212, 222
 rosulata 222
 sedifolia 222
 squalida 222, 226
 subaromatica 222
 tristis
 ssp. asiae-centralis 222
- Trametes 416
 roseola 413, 415-416
- Tranzschelia 328
 discolor 328
- Trapeliopsis
 gelatinosa 222
 granulosa 222
- Tremolecia
 atrata 222
- Trichophaeopsis 234
- Trimmatostroma
 lichenicola 227
- Tuckermannopsis
 ciliaris 202, 222
 pinastri 222-223
 sepincola 202, 222
- Tulostoma
 cyclophorum 332
- Uleoportha 463
 orbiculata 463

- Umbilicaria
 arctica 223
 cylindrica 223
 decussata 223, 225
 deusta 223
 hirsuta 223
 hyperborea 223
 lyngei 223
 polyphylla 223
 proboscidea 223
 torrefacta 223
 vellea 223
 virginis 223
 Urceolaria
 actinostoma
 var. aenea 273-274
 bispora
 var. terricola 269, 276
 chloroleuca 276
 hypoleuca 284
 stictica 288
 Uromyces 328
 Uromycladium 328
 Usnea 223
 submolis 378, 380, 383
 Ustilago 169
 Valsa 422
 apatosa 452
 bignoniae 453
 bitorulosa 453
 celtidis 431, 434, 454
 ceratosperma 421, 453, 456
 cincta 434
 clethraecola 431, 434, 455
 complexa 455
 decorticans 421, 456
 fulvopruinata 426, 457
 melastroma 461
 nigrofacta 431, 434, 462
 notarisii 430, 462
 oleifera 463
 parmularia 463
 peckii 442, 463
 phlyctaenodes 430, 464
 purpurascens 464
 thelebola 467
 toxici 467
 Valsaria 419-424, 428, 430, 434, 438-440,
 443, 450-451, 454, 456-458, 461, 463,
 465-467, 474
 acericola 450
 actidia 450
 aethiops 431, 451
 akebiae 451, 455
 allantospora 419, 439, 451
 ampelina 468
 angularis 451
 anserina 451
 anthostomoides 441-442, 452
 apatosa 452
 apiculata 452
 arxii 468
 atrata 431, 433, 452
 atrofusca 452
 bambusae 419, 423, 425-426, 429, 434,
 453, 474-475
 batesii 432, 434, 453
 beaumontii 453
 bignoniae 453
 bitorulosa 453
 caproni 454
 cariei 454
 celtidis 431, 454
 chilensis 420, 445, 454
 cincta 430, 454
 cinnamomi 435, 454
 citri 432-433, 454
 clavatiasca 454, 456, 462, 467
 clethraecola 431, 455
 collematoides 455
 colludens 455
 coloradensis 439, 455
 complexa 455
 consors 432, 434, 455
 cornicola 451, 455
 cryptomeriae 432-433, 455
 decipiens 455
 decorticans 421, 426, 430, 437, 455-456
 diospyri 456
 discoidea 454, 456
 donacicola 420, 445-446, 456
 donacina 421, 456
 durissima 435-436, 456
 eucalypti 435, 457
 f. lusitanica 432, 434, 457
 exasperans 420, 427-430, 437, 457
 var. aceris 427, 457
 farlowiana 431, 434, 457
 fennica 441, 457
 ficophila 468
 foedans 421, 441-442, 457
 fraxini 457
 fulvopruinata 419-420, 423, 425-426,
 429, 437, 455-457, 460, 464, 474-475
 gemmata 435, 457
 gleditschiae 457
 grandinea 457
 gregalis 458
 haraeana 458
 hookeri 458
 hurae 436, 458
 hypoxyloides 422-423, 429, 435-437, 459
 hysterioides 459
 indica 432-433, 437, 459
 insitiva 419-423, 425-430, 433-435, 437,
 451-457, 459-468, 474
 var. coluteae 432, 459
 var. linderae 432-433, 460
 f. acaciae-caveniae 432, 459
 f. carpini-betuli 431, 433, 459
 f. celtidis 431, 433, 459
 f. cordiae-gerascanthi 432, 459
 f. deminuta-negundinis 431, 433, 459

[Valsaria insitiva]

- f. fraxini-orni 431, 433, 460
- f. gleditschiae 431-432, 460
- f. gleditschiae-triakanthi 430, 433, 460
- f. mimosae-polycarpae 432, 460
- f. mori-albae 431, 433, 460
- f. paliuri-aculeati 431, 433, 460
- f. parkinsoniae 431-432, 460
- f. polygoni 432, 460
- f. quercus-pedunculatae 431, 433, 460
- f. rauwolfiae 432, 460
- f. robiniae-pseudacaciae 431, 433, 460
- f. ulmi-campestris 430, 433, 460
- f. wistariae 431, 433, 460
- kriegeriana 460
- kriegeri 460
- kunzeana 427, 437, 460
- latitans 460
- leonensis 461
- lignicola 441, 461
- lophiostoma 468
- magnoliae 461
- majuscula 461
- manihotis 468
- massarioides 461
- mata 432, 461
- megalospora 461
- melastroma 461
- microspora 468
- milletiae 468
- minor 441-442, 462
- moroides 419, 441, 461
- mundkurina 436-437, 462
- natalensis 454, 462
- neurospora 468
- niesslii 441, 462
- nigrofacta 431, 462
- nigrospora 462
- notarisii 430, 462
- nudicollis 462
- oleifera 462-463
- parmularia 463
- peckii 440, 442, 463
- periplocae 421, 430, 463
- petrakii 440, 463
- phlyctaenodes 430, 464
- phoradendri 464
- pseudohypoxylon 436, 464
- purpurascens 464
- purpurea 435-436, 464
- pustulans 420, 448, 464
- quadrata 427-428, 464
- rehmiana 436, 464
- rehmii 464
- reticulata 436, 438, 464
- ribicola 468
- robiniae 421, 430, 464
- rubricosa 419, 422-425, 427-430, 435, 437-438, 450, 454, 456-459, 462, 464-465, 474
- var. cydoniae 468
- rudis 431, 465
- saccardiana 465
- salicina 441-442, 465
- salvadorina 465, 474
- sarothamni 465
- sarraziniana 465
- spartii 432-433, 465
- sphaerophora 423, 465-466
- spiculosa 466
- spurca 466
- squarrosa 466
- staphylina 466
- stellulata 438-439, 466
- strebli 466
- striispora 468
- subcoccodes 466
- subtropica 454, 466-467
- syconophila 430, 467
- symphoricarpi 467
- tamaricis 435, 467
- tax. sp-1
- theissenii 467
- thelebola 467
- tiliae 467
- toxici 467
- tubaroensis 468
- viticola 431, 468
- xanthoxyli 431, 434, 468
- Valsarioxylon
 - peckii 442
- Valsonectria 419, 423, 437, 450
 - andina 451
 - boldoae 453
 - cinnamomi 435-436, 454
 - hypoxylodes 435, 459
 - orbiculata 463
 - pulchella 423
 - reticulata 436-437, 464
 - verrucosa 437
- Varicellaria
 - rhodocarpa 223
- Verrucaria
 - actinostoma 272
 - aethiobola 223
 - cataleptoides 223
 - deversa 223
 - margacea 223
 - riparia 223
- Vesiculomyces 2-3
 - citrinus 6
 - epitheloides 3
 - lactescens 55
 - luridus 58
 - wakullus 61
- Volvaria 357
- Vulpicida
 - juniperinus 202, 223
 - pinastri 202, 222-223
 - tieslii 202, 223
- Wentomyces
 - peltigericola 227

Wrightoporia 8-10

WRIGHTOPORIOIDEAE 1, 8

Xanthoparmelia 262

conspersa 223

somloënsis 214, 223

taractica 223

Xanthoria 224, 261

borealis 185, 224, 226

candelaria 224

elegans 217, 224, 226

fallax 224

fruticulosa 217

polycarpa

var. substellaris 224

sorediata 224

subfruticulosa 224

Xylaria 358, 483, 485

entosulphurea 483-485

Xylobolus 8

Xylobotryum 454

Xylographa

abietina 224

parallela 224

trunciseda 224

vitiligo 185, 224

Xylosphaeria

saccardiana 465

Zwackhiomyces

berengerianus 227

dispersus 227

Reviewers, Volume Fifty-Eight

The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume:

M. T. Adler	T. L. Esslinger	T. H. Nash
T. Ahti	M. A. Flannery	I. G. Pascoe
J. Boidin	W. Gams	L. E. Petrini
I. Brodo	J. Ginns	D. H. Pfister
P. Buchanan	R. D. Goos	Z. Pouzar
B. Callan	G. Hall	C. T. Rogerson
L. M. Carris	N. Hallenberg	H. D. Thiers
H. - S. Chang	R. T. Hanlin	L. Tibell
Y. - R. Chung	G. Kantvilas	D. J. Weber
E. Descals	N. Lundqvist	W. - Y. Zhuang
J. A. Elix	O. K. Miller	

Publication Date Volume Fifty-Seven

MYCOTAXON for January-March 1996, volume 57: 1-524
was issued on February 19, 1996.

EDITORS OF MYCOTAXON

JEAN BOISE CARGILL, *Editor-in-Chief*

Harvard University Herbaria, 22 Divinity Ave.

Cambridge, MA 02138, U.S.A.

ASSOCIATE EDITORS

Karen Gettleman
Index Editor
Indiana University
Bloomington, IN

David S. Hibbett
Book Review Editor
Harvard Univ. Herbaria,
Cambridge, MA USA

G. L. Hennebert
French Language Editor
32 Rue de l'Elevage
B-1340 Louvain-la-Neuve
Belgium

Pavel Lizon
Asst. to the Ed.in-Chief
Plant Pathology Herbarium,
Cornell Univ.
Ithaca, NY USA

MYCOTAXON is a quarterly journal devoted to all phases of mycological taxonomy and nomenclature. All articles are reviewed by specialists prior to acceptance. Publication is open to all persons. Papers may be in French or in English. Summaries in those or any additional languages desired by the authors are given for longer articles. Printing is on high quality, acid-free book paper. Authors prepare their own *camera-ready* copy after having received critical comments from pre-submission reviewers. *Instructions to Authors* appeared in MYCOTAXON 50: 493-497, 1994. A copy of these instructions will be sent upon request to the Editor-in-Chief.

SUBSCRIPTION INFORMATION

Each volume, beginning with volume 3, contains at least 512 pages, and consists of an *irregular* number of quarterly issues (rarely an *additional* issue, a Festschrift, may be included in a volume). Each issue of MYCOTAXON varies in number of pages. Subscriptions are normally on a *per volume* basis, but subscribers may choose an *annual* basis to avoid frequent billing. Currently this would involve prepaying three volumes. *Personal subscriptions* are available at a substantially reduced rate for *individuals* who agree not to deposit their copies in another library than their personal one within 3 years of receipt. Address all orders to the Mycotaxon Order Department, *not* to the Editors. Prices beginning with volume 53 are:

	USA	Canada/Mexico	Other Foreign (Air)
REGULAR (multiuser)	\$65.00	\$67.00 U S	\$70.00 U S
PERSONAL (individual)	\$30.00	\$32.00 U S	\$37.00 U S

(All back volumes are still available. All complete volumes are available at \$30.00 per volume when shipped by surface mail, \$45 per volume by air mail, except vols. 1, 34 and 46 available only in complete runs.)

Place subscriptions through the ORDER DEPT., MYCOTAXON, LTD., P. O. BOX 264, ITHACA, NY 14851-0264, U. S. A., or through your agent. MYCOTAXON may also be obtained on a journal-exchange basis. This may be arranged with journals, institutions, or individuals who have difficulty in obtaining foreign currency.

TWENTY-VOLUME CUMULATIVE INDICES, 1974-1984 & 1984-1991

MYCOTAXON CUMULATIVE INDEX FOR VOLUMES I-XX (1974-1984) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-00-5) is available at \$17.50 *postpaid*, and MYCOTAXON CUMULATIVE INDEX FOR VOLUMES XXI-XL (1984-1991) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-01-3) is available at \$30.00 *postpaid*, MYCOTAXON, LTD., P. O. BOX 264, ITHACA, NY, 14851-0264, U.S.A.

AVAILABILITY IN MICROFORM, TEAR SHEET & PHOTOCOPY

MYCOTAXON is also available in *microfiche* and in *microfilm* from University Microfilms, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A., or 30-32 Mortimer Street, London W1N 7RA, England, from whom prices may be obtained. Tear sheets or photocopies of individual articles may be obtained through *The Genuine Article™*, I.S.I., 3501 Market Street, Philadelphia, PA 19104, U.S.A.

RECENT BOOKS PUBLISHED BY MYCOTAXON, LTD. [i.b.f.]

FIFTY YEARS OF FUN WITH THE DISCOMYCETES AND WHAT'S LEFT TO DO by Richard P. Korf (1994) 18 pp., spiral bound, 8-1/2 x 11 inches, illustrated, \$6 *postpaid*, \$9 *airmail*.

FUNGI OF CHINA by S. C. Teng (1996), edited by Richard P. Korf, 586+xiv pp., cloth-bound, 8-1/2 x 11 inches, 426 illustrations, 1 map, 1 photograph, \$79 *postpaid*, \$94 *airmail*.

CONTACTING MYCOTAXON'S EDITOR-IN-CHIEF BY E-MAIL OR BY FAX

To reach the Editor-in-Chief regarding manuscripts, you may E-Mail to cargill@oeb.harvard.edu or you may FAX to Jean Cargill at (617) 495-9484.

CONTACTING MYCOTAXON'S ORDER DEPARTMENT BY E-MAIL OR FAX

To reach the Order Department for information or placing orders, you may E-MAIL to rkorf@innet.com or you may FAX to Richard Korf at (607) 273-4357.

